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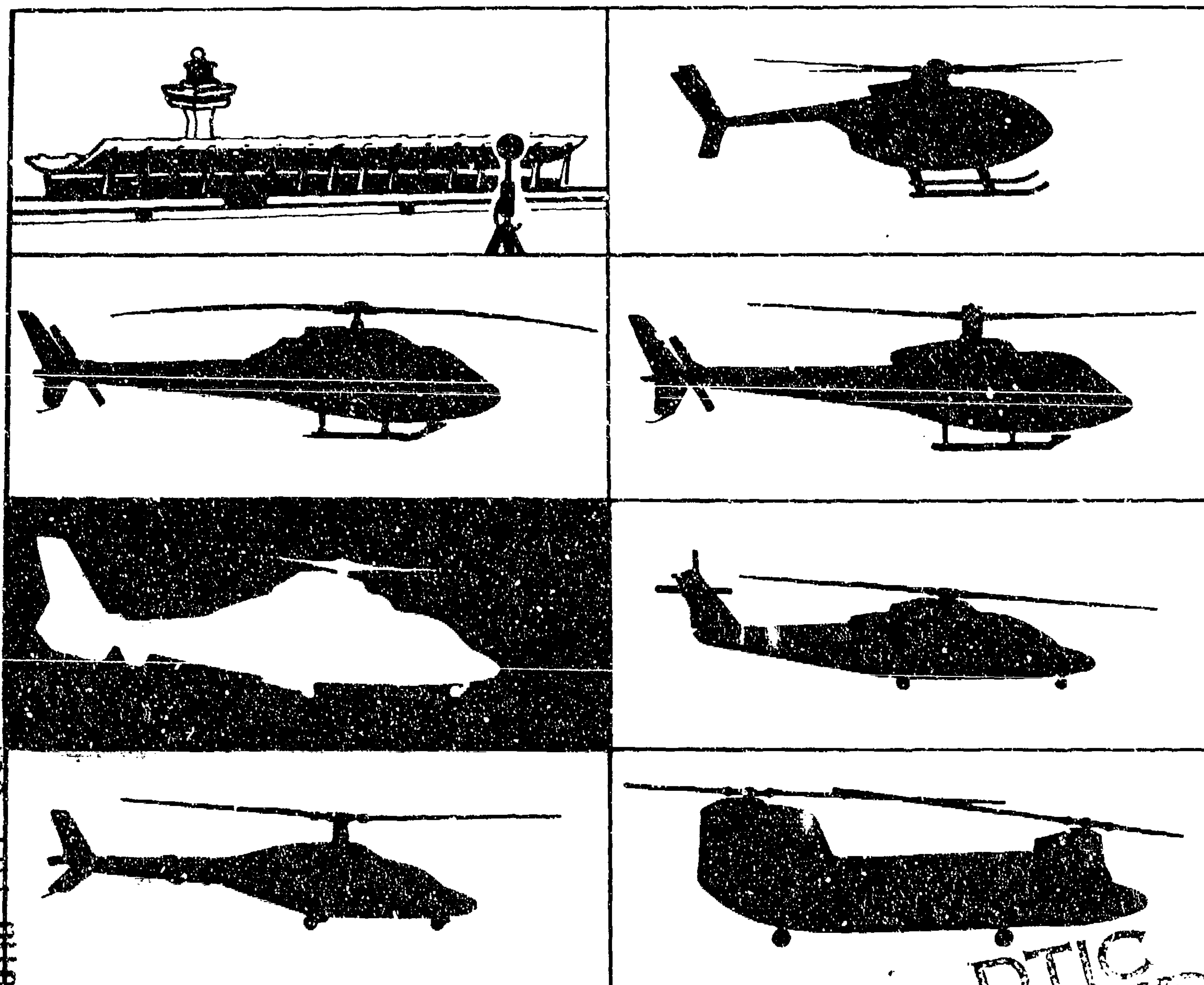
Washington, D.C. 20591

Noise Measurement Flight Test: Data/Analyses Aerospatiale SA 365N Dauphin 2 Helicopter



by
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ABOUT THE COVER

The cover of this report (and subsequent reports in this series) is comprised of silhouettes of the seven helicopters tested during the summer of 1983 at Dulles International Airport. The highlighted outline is that of the Aerospatiale Dauphin the subject of this report. The helicopters shown on the cover include (clockwise from the upper right) the Hughes 500-D, the Aerospatiale TwinStar, the Sikorsky S-76, the Boeing Vertol BV-234/CH-47D, the Bell 222, the Aerospatiale Dauphin, and the Aerospatiale AStar.

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16. Abstract
This report documents the results of a Federal Aviation Administration (FAA) noise measurement flight test program with the Dauphin twin-jet helicopter. The report contains documentary sections describing the acoustical characteristics of the subject helicopter and provides analyses and discussions addressing topics ranging from acoustical propagation to environmental impact of helicopter noise.

This report is the second in a series of seven documenting the FAA helicopter noise measurement program conducted at Dulles International Airport during the summer of 1983. The Dauphin test program involved the acquisition of detailed acoustical, position and meteorological data.

This test program was designed to address a series of objectives including: 1) acquisition of acoustical data for use in assessing heliport environment impact, 2) documentation of directivity characteristics for static operation of helicopters, 3) establishment of ground-to-ground and air-to-ground acoustical propagation relationships for helcipters, 4) determination of noise event duration influences on energy dose acoustical metrics, 5) examination of the differences between noise measured by a surface mounted microphone and a microphone mounted at a height of four feet (1.2 meters), and 6) documentation of noise levels acquired using international helicopter noise certification test procedures.

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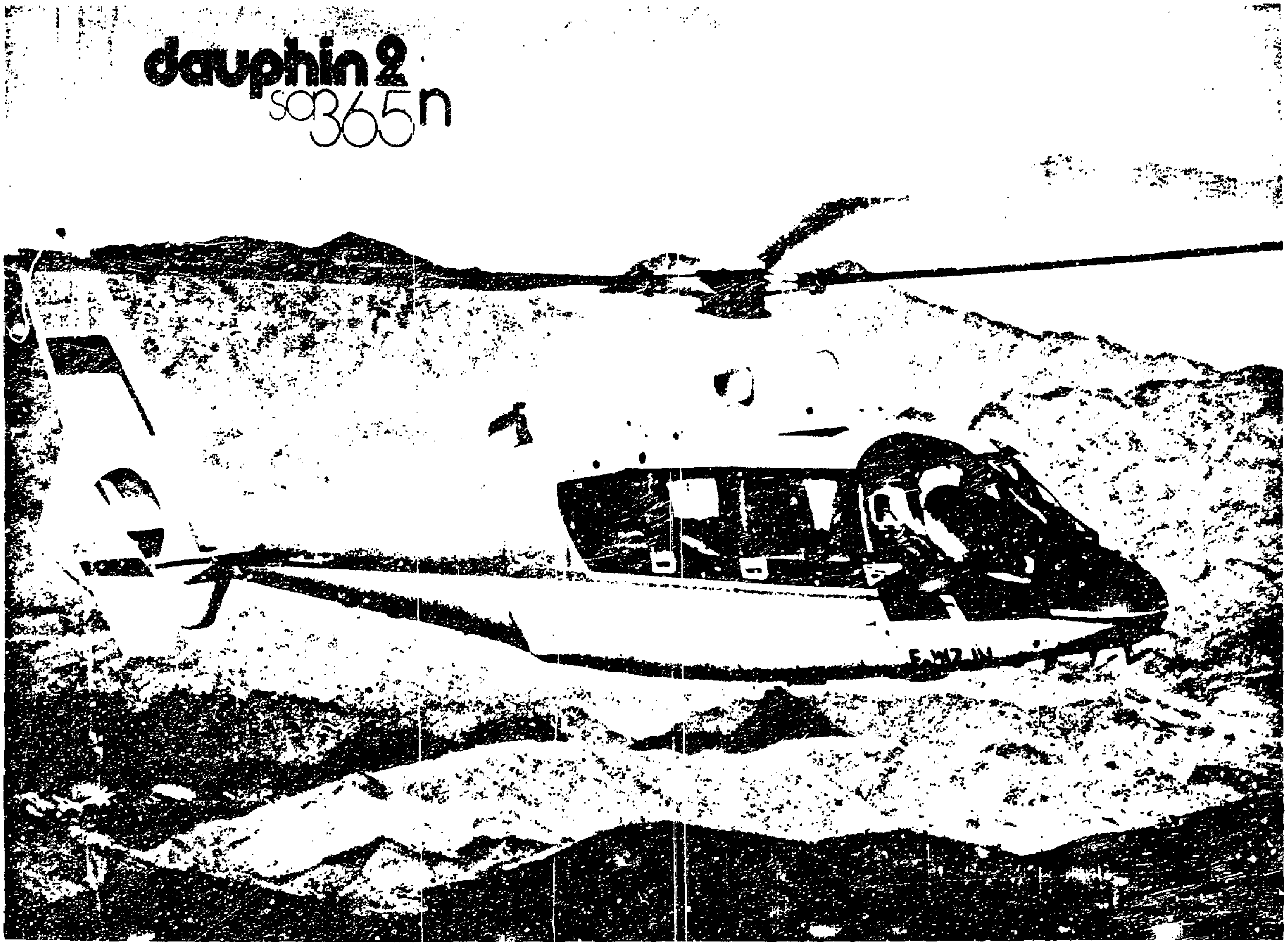
4. Mr. Tyrone L. Bland for software development used in the analyses in this report.

5. Ms. Loretta Harrison for her typing and report production assistance.

DAUPHIN: The eldest son of the King of France (used as a title from 1349 - 1830).



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GLOSSARY

AGL	-	Above ground level
AIR	-	Aerospace Information Report
AL	-	A-Weighted sound level, expressed in decibels (See L_A)
AL_M	-	Maximum A-weighted sound level, expressed in decibels (see L_{AM})
AL_{AM}	-	As measured maximum A-weighted Sound Level
ALT	-	Aircraft altitude above the microphone location
APP	-	Approach operational mode
CLC	-	Centerline Center
CPA	-	Closest point of approach
d	-	Distance
dB	-	Decibel
dBA	-	A-Weighted sound level expressed in units of decibels (see A_L)
df	-	Degree of freedom
Δ	-	Delta, or change in value
$\Delta 1$	-	Correction term obtained by correcting SPL values for atmospheric absorption and flight track deviations per FAR 36, Amendment 9, Appendix A, Section A36.11, Paragraph d
$\Delta 2$	-	Correction term accounting for changes in event duration with deviations from the reference flight path
DUR(A)	-	"10 dB-Down" duration of L_A time history
EPNL	-	Effective perceived noise level (symbol is LEPN)

EV	-	Event, test run number
FAA	-	Federal Aviation Administration
FAR	-	Federal Aviation Regulation
FAR-36	-	Federal Aviation Regulation, Part 36
GLR	-	Graphic level recorder
HIGE	-	Hover-in-ground effect
HOGE	-	Hover-out-of-ground effect
IAS	-	Indicated airspeed
ICAO	-	International Civil Aviation Organization
IRIG-B	-	Inter-Range Instrumentation Group B (established technical time code standard)
J	-	The value which determines the radiation pattern
K(A)	-	Propagation constant describing the change in dBA with distance
K(DUR)	-	The constant used to correct SEL for distance and velocity duration effects in $\Delta 2$
KIAS	-	Knots Indicated Air Speed
K(S)	-	Propagation constant describing the change in SEL with distance
Kts	-	Knots
L_A	-	A-Weighted sound level, expressed in decibels
Leq	-	Equivalent sound level
LFO	-	Level Flyover operational mode
N	-	Sample Size
NWS	-	National Weather Service
$OASPL_M$	-	Maximum overall sound pressure level in decibels
PISLM	-	Precision integrating sound level meter

PNL_M	-	Maximum perceived noise level
$PNLT_M$	-	Maximum tone corrected perceived noise level
POP	-	Photo overhead positioning system
Q	-	Time history "shape factor"
RH	-	Relative Humidity in percent
RPM	-	Revolutions per minute
SAE	-	Society of Automotive Engineers
SEL	-	Sound exposure level expressed in decibels. The integration of the AL time history, normalized to one second (symbol is L_{AE})
SEL_{AM}	-	As measured sound exposure level
$SEL-AL_M$	-	Duration correction factor
SHP	-	Shaft horse power
SLR	-	Single lens reflex (35 mm camera)
SPL	-	Sound pressure level
T	-	Ten dB down duration time
TC	-	Tone correction calculated at $PNLT_M$
T/O	-	Takeoff
TSC	-	Department of Transportation, Transportation Systems Center
V	-	Velocity
VASI	-	Visual Approach Slope Indicator
V_H	-	Maximum speed in level flight with maximum continuous power
V_{NE}	-	Never-exceed speed
Vy	-	Velocity for best rate of climb

INTRODUCTION

1.0 Introduction - This report documents the results of a Federal Aviation Administration (FAA) noise measurement/flight test program involving the Aerospatiale Dauphin twin-jet helicopter. The report contains documentary sections describing the acoustical characteristics of the subject helicopter and provides analyses and discussions addressing topics ranging from acoustical propagation to environmental impact of helicopter noise.

This report is the second in a series of seven documenting the FAA helicopter noise measurement program conducted at Dulles International Airport during the summer of 1983.

The Dauphin test program was conducted by the FAA in cooperation with Aerospatiale Helicopter Corporation and a number of supporting Federal agencies. The rigorously controlled tests involved the acquisition of detailed acoustical, position and meteorological data.

This test program was designed to address a series of objectives including: 1) acquisition of acoustical data for use in heliport environmental impact analyses, 2) documentation of directivity characteristics for static operation of helicopters, (3) establishment of ground-to-ground and air-to-ground acoustical propagation relationships for helicopters, 4) determination of noise event duration influences on energy dose acoustical metrics, 5) examination of the differences between noise measured by a surface mounted microphone and a microphone mounted at a height of four feet (1.2 meters), and 6) documentation of noise levels acquired using international helicopter noise certification test procedures.

The appendices to this document provide a reference set of acoustical data for the Dauphin helicopter operating in a variety of typical flight regimes. The first seven chapters contain the introduction and description of the helicopter, test procedures and test equipment. Chapter 8 describes analyses of flight trajectories and meteorological data and is documentary in nature. Chapter 9 delves into the areas of acoustical propagation, helicopter directivity for static operations, and variability in measured acoustical data over various propagation surfaces. The analyses of Chapter 9 in some cases succeed in establishing relationships characterizing the acoustic nature of the subject helicopter, while in other instances the results are too variant and anomalous to draw any firm conclusions. In any event, all of the analyses provide useful insight to people working in the field of helicopter environmental acoustics, either in providing a tool or by identifying areas which need the illumination of further research efforts.

TEST HELICOPTER DESCRIPTION

2.0 Test Helicopter Description - The SA 365N Dauphin 2 is a twin turbin-powered transport helicopter capable of carrying eight passengers and a crew of two. The helicopter is manufactured by Aerospatiale Helicopter Corporation of Grand Prairie, Texas, and was certificated by the FAA in November 1981. Standard features of the aircraft include a 177 cubic foot cabin with removable passenger seats, provision for air conditioning and soundproofing, and a baggage compartment of approximately 55 cubic feet. An additional feature of the aircraft is the fenestra, a tail rotor encased in a shroud or duct and mounted in line with the tailcone axis.

Besides the standard configuration, the helicopter is available in a special aeromedical version. The "intensive care" layout of this version allows for transportation of two patients on stretchers, a doctor and medical equipment. The "ambulance" layout allows for transportation of four patients on stretchers, a doctor and equipment.

Selected operational characteristics, obtained from the helicopter manufacturer, are presented in Table 2.1.

Table 2.2 presents a summary of the flight operational reference parameters determined using the procedures specified in the International Civil Aviation Organization (ICAO) noise certification testing requirements. Presented along with the operational parameters are the altitudes that one would expect the helicopter to attain (referred to the ICAO reference test sites). This information is provided so that the reader may implement an ICAO type data correction using the "As Measured" data contained in this report. This report does not undertake such a correction, leaving it as the topic of a subsequent report.

TABLE 2.1

HELICOPTER CHARACTERISTICS

HELICOPTER MANUFACTURER	: Aerospatiale Helicopter Corporation
HELICOPTER MODEL	: SA 365N Dauphin 2
HELICOPTER TYPE	: Single rotor
TEST HELICOPTER N-NUMBER	: 365 AH
MAXIMUM GROSS TAKEOFF WEIGHT	: 8488 lbs (3850 kg)
NUMBER AND TYPE OF ENGINE(S)	: 2 Turbomeca ARRIEL 1C
SHAFT HORSE POWER (PER ENGINE)	: 710 HP
MAXIMUM CONTINUOUS POWER	: 594 HP
SPECIFIC FUEL CONSUMPTION AT MAXIMUM POWER (LB/HR/HP)	: 85 LBS/HR/HP
NEVER EXCEED SPEED (V_{NE})	: 175 KTS
MAX SPEED IN LEVEL FLIGHT WITH MAX CONTINUOUS POWER (V_H)	: 150 KTS TAS @3850 kg Sea Level Standard
SPEED FOR BEST RATE OF CLIMB (Vy)	: 75 KTS
BEST RATE OF CLIMB	: 1600 fpm

MAIN AND TAIL ROTOR SPECIFICATIONS

	MAIN	TAIL
ROTOR SPEED (100%)	: 365 rpm	4706 rpm
DIAMETER	: 470 in.(11.93m)	35.4 in.(.9 m)
CHORD	: 385mm (15.2 in)	1.71 in.
NUMBER OF BLADES	: 4	13
PERIPHERAL VELOCITY	: 748 fps	727 fps
DISK LOADING	: 7.07 lbs/ft^2	———
FUNDAMENTAL BLADE PASSAGE FREQUENCY	: 24 Hz	1020 Hz
ROTATIONAL TIP MACH NUMBER (77°F)	: .6587	.6402

TABLE 2.2

ICAO REFERENCE PARAMETERS

	TAKEOFF	APPROACH	LEVEL FLYOVER
AIRSPEED (KTS)	: 75	75	135
RATE OF CLIMB/DESCENT (fpm)	: 1600	794	N/A
CLIMB/DESCENT ANGLE (DEGREES)	: 12.2°	6°	N/A
ALTITUDE/CPA (FEET)			
SITE 5	: 221/216	329/327	492
SITE 1	: 355/347	394/392	492
SITE 4	: 461/451	446/443	492
SLANT RANGE (FEET) TO			
SITE 2	: 607	630	696
SITE 3	: 607	630	696

TEST SYNOPSIS

3.0 Test Synopsis - Below is a listing of pertinent details pertaining to the execution of the helicopter tests.

1. Test Sponsor, Program Management, and Data Analysis: Federal Aviation Administration, Office of Environment and Energy, Noise Abatement Division, Noise Technology Branch (AEE-120).

2. Test Helicopter: SA 365N Dauphin 2, provided by Aerospatiale Helicopter Corporation

3. Test Date: Monday, June 6, 1983

4. Test Location: Dulles International Airport, Runway 30 over-run area.

5. Noise Data Measurement (recording), processing and analysis: Department of Transportation (DOT), Transportation Systems Center (TSC), Noise Measurement and Assessment Facility.

6. Noise Data Measurement (direct-read), processing and analaysis: FAA, Noise Technology Branch (AEE-120).

7. Cockpit instrument photo documentation; photo-altitude determination system; documentary photographs: Department of Transportation, Photographic Services Laboratory.

8. Meteorological Data (fifteen minute observations): National Weather Service Office, Dulles International Airport.

9. Meteorological Data (radiosonde/rawinsonde weather balloon launches): National Weather Service Upper Air Station, Sterling Park, Virginia.

Flight Test and Noise Measurement Personnel In Action

FIGURE 3.1

10. Meteorological Data (on site observations): DOT-TSC.

11. Flight Path Guidance (portable visual approach slope indicator (VASI) and theodolite/verbal course corrections): FAA Technical Center, ACT-310.

12. Air Traffic Control: Dulles International Airport Air Traffic Control Tower.

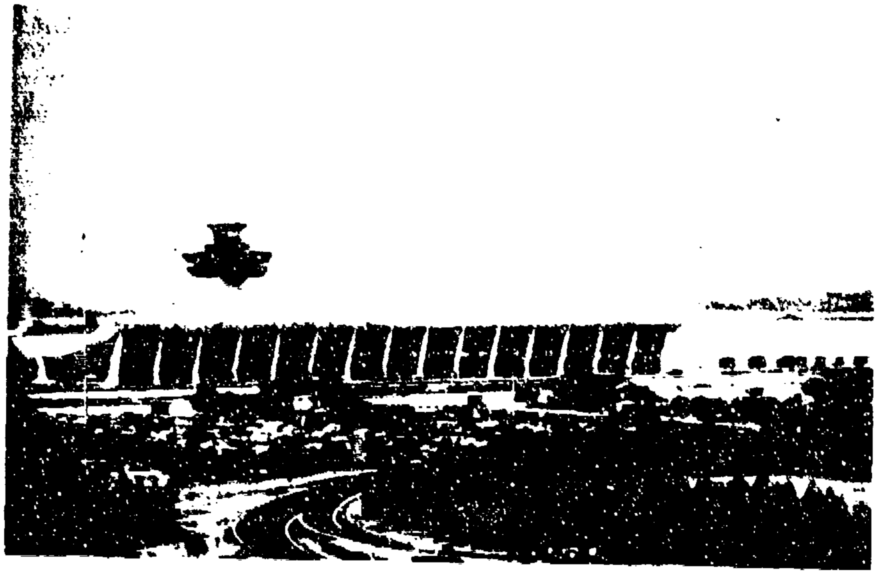
13. Test site preparation; surveying, clearing underbrush, connecting electrical power, providing markers, painting signs, and other physical arrangements: Dulles International Airport Grounds and Maintenance, and Airways Facilities personnel.

Figure 3.1 is a photo collage of flight test and measurement personnel performing their tasks.

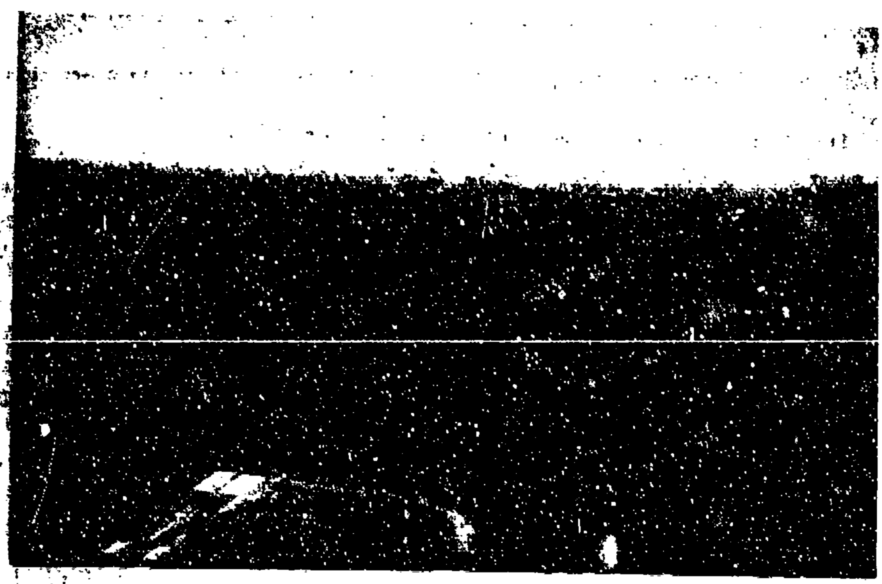
3.1 Measurement Facility - The noise measurement testing area was located adjacent to the approach end of Runway 12 at Dulles International Airport. (The approach end of Runway 12 is synonymous with Runway 30 over-run area.) The low ambient noise level, the availability of emergency equipment, and the security of the area all made this location desirable. Figure 3.2 provides a photograph of the Dulles terminal and of the test area.

The test area adjacent to the runway was nominally flat with a ground cover of short, clipped grass, approximately 1800 feet by 2200 feet, and bordered on north, south, and west by woods. There was minimum interference from the commercial and general aviation activity at the airport since Runway 12/30 was closed to normal traffic during the tests. The runways used for normal traffic, 1L and 1R, were approximately 2 and 3 miles east, respectively, of the test site.

Figure 3.2



The Terminal and Air Traffic Control Tower
at Dulles International Airport



Approach to Runway 12 at Dulles Noise
Measurement Site for 1983 Helicopter Tests

The flight track centerline was located parallel to Runway 12/30 between the runway and the taxiway. The helicopter hover point for the static operations was located on the southwest corner of the approach end of Runway 12. Eight noise measurement sites were established in the grassy area adjacent to the Runway 12 approach ground track.

3.2 Microphone Locations - There were eight separate microphone sites located within the testing area, making up two measurement arrays. One array was used for the flight operations, the other for the static operations. A schematic of the test area is shown in Figure 3.3.

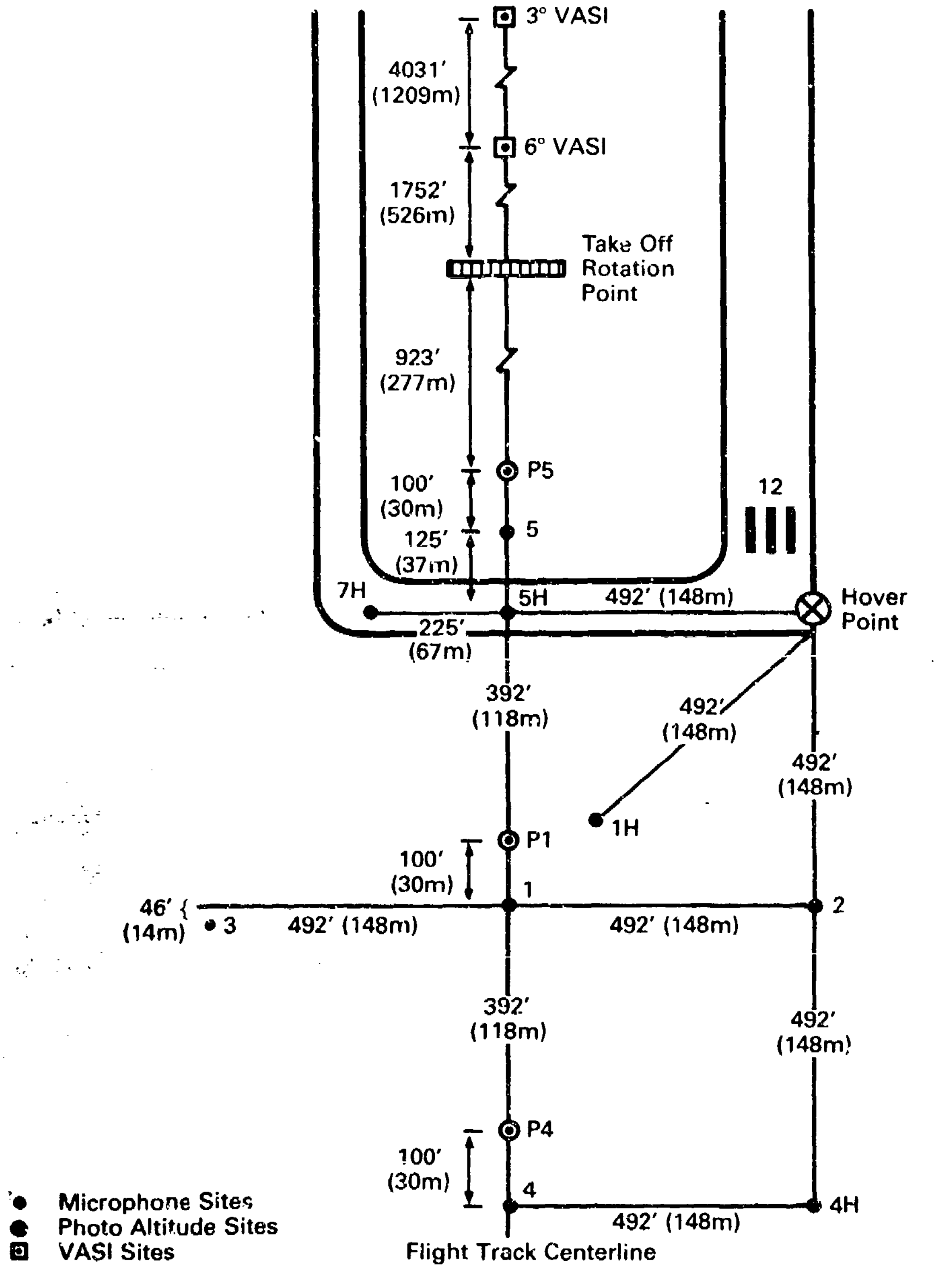
A. Flight Operations - The microphone array for flight operations consisted of two sideline sites, numbered 2 and 3 in Figure 3.3, and three centerline sites, numbered 5, 1, and 4, located directly below the flight path of the helicopter. Since site number 3, the north sideline site, was located in a lightly wooded area, it was offset 46 feet to the west to provide sufficient clearance from surrounding trees and bushes.

B. Static Operations - The microphone array for static operations consisted of sites 7H, 5H, 1H, 2, and 4H. These sites were situated around the helicopter hover point which was located on the southwest corner of the approach end of Runway 12. These site locations allowed for both hard and soft ground-to-ground propagation paths.

3.3 Flight Path Markers and Guidance System Locations - Visual cues in the form of squares of plywood painted bright yellow with a black "X" in the center were provided to define the takeoff rotation point. This point was located 1640 feet (500 m) from centerline center (CLC) microphone

FIGURE 3.3

Noise Measurement and Photo Site Schematic



NOTES: Broken Line Indicates not to Scale.
Metric Measurements to
Nearest Meter.

location. Four portable, battery-powered spotlights were deployed at various locations to assist pilots in maintaining the array centerline. To provide visual guidance during the approach portion of the test, a standard visual approach slope indicator (VASI) system was used. In addition to the visual guidance, the VASI crew also provided verbal guidance with the aid of a theodolite. Both methods assisted the helicopter pilot in adhering to the microphone array centerline and in maintaining the proper approach path. The locations of the VASI from CLC are shown in the following table.

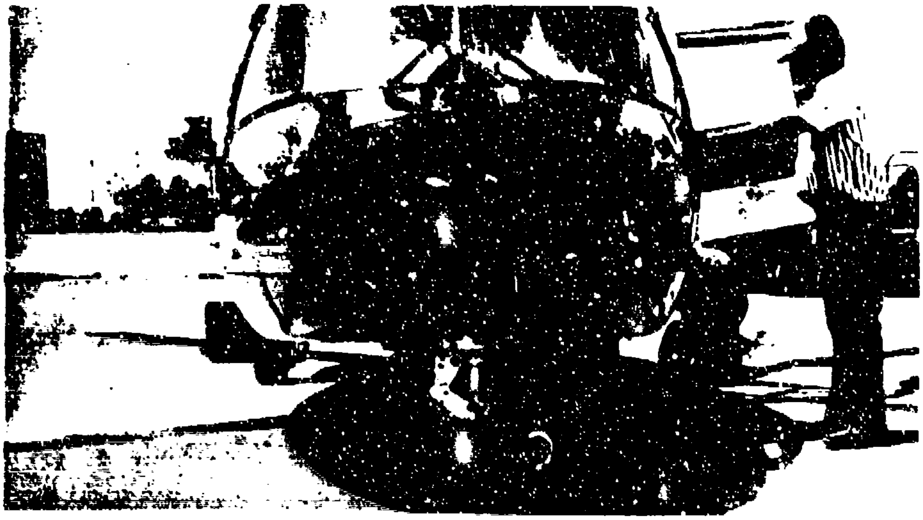
Approach Angle (degrees)	Distance from CLC (feet)
12	1830
9	2456
6	3701
3	7423

Each of these locations provided a glidepath which crossed over the centerline center microphone location at an altitude of 394 feet.

FIGURE 3.4

SA 365N

DAUPHIN 2



Nose view

Side profile

Tail view

TEST PLANNING AND BACKGROUND

4.0 Test Planning/Background Activities - This section provides a brief discussion of important administrative and test planning activities.

4.1 Test Program Advance Briefings and Coordination - A pre-test briefing was conducted approximately one month prior to the test. The meeting was attended by all pilots participating in the test, along with FAA program managers, manufacturer test coordinators, and other key test participants from the Dulles Airport community. During this meeting, the airspace safety and communications protocol were rigorously defined and at the same time test participants were able to iron out logistical and procedural details. On the morning of the test, a final brief meeting was convened on the flight line to review safety rules and coordinate last-minute changes in the test schedule.

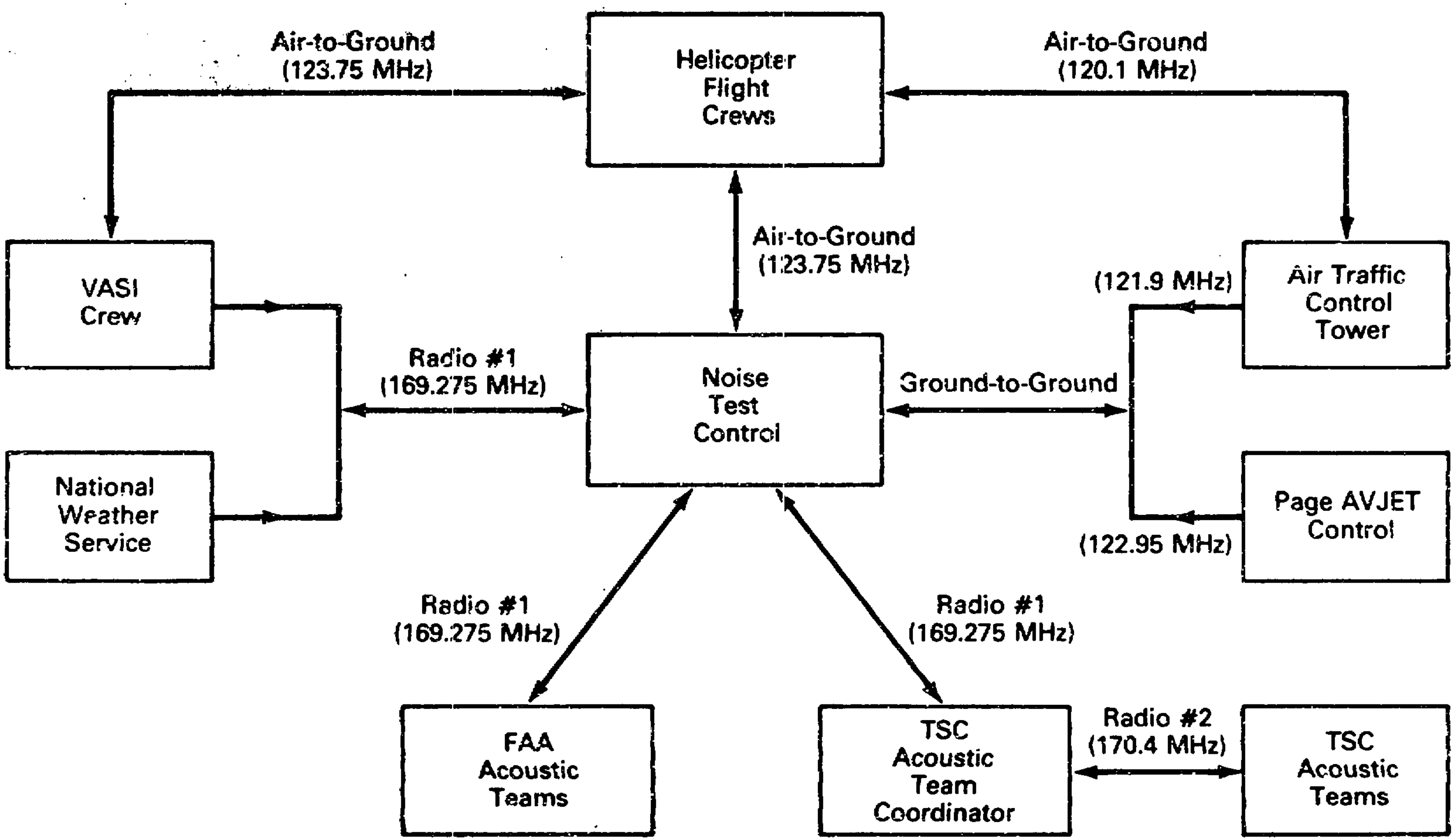
4.2 Communications Network - During the helicopter noise measurement test, an elaborate communications network was utilized to manage the various systems and crews. This network was headed by a central group which coordinated the testing using three two-way radio systems, designated as Radios 1-3.

Radio 1 was a walkie talkie system operating on 169.275 MHz, providing communications between the VASI, National Weather Service, FAA Acoustic Measurement crew, the TSC acoustic team coordinator, and the noise test coordinating team.

Radio 2 was a second walkie talkie system operating on 170.40 MHz, providing communications between the TSC acoustic team coordinator and the TSC acoustic measurement teams.

FIGURE 4.1

Helicopter Noise Test Communication Network Schematic



Radio 3, a multi-channel transceiver, was used as both an air-to-ground and ground-to-ground communications system. In air-to-ground mode it provided communications between VASI, helicopter flight crews, and noise test control on 123.175 MHz. In ground-to-ground mode it provided communications between the air traffic control tower (121.9 MHz), Page Avjet (the fuel source) (122.95 MHz), and noise test control.

A schematic of this network is shown in Figure 4.1.

4.3 Local Media Notification - Noise test program managers working through the FAA Office of Public Affairs released an article to the local media explaining that helicopter noise tests were to be conducted at Dulles Airport on June 6 the test day commencing around dawn and extending through midday. The article described general test objectives, flight paths, and rationale behind the very early morning start time (low wind requirements). In the case of a farm located very close to the airport, a member of the program management team personally visited the residents and explained what was going to be involved in the test. As a consequence of these efforts (it is assumed), there were very few complaints about the test program.

4.4 Ambient Noise - One of the reasons that the Dulles Runway 30 over-run area was selected as the test site was the low ambient noise level in the area. Typically one observed an A-Weighted LEQ on the order of 45 dB, with dominant transient noise sources primarily from the avian and insect families. The primary offender was the Collinus Virginianus, commonly known as the bobwhite, quail, or partridge. The infrequent intrusive sound pressure levels were on the order of 55 dB centered in the 2000 Hz one-third octave band.

As an additional measure for safety and for lessening ambient noise, a Notice to Airmen or NOTAM was issued advising aircraft of the noise test, and indicating that Runway 12/30 was closed for the duration of the test.

5.0 Data Acquisition and Guidance Systems - This section provides a detailed description of the test program data acquisition systems, with special attention given to documenting the operational accuracy of each system. In addition, discussion is provided (as needed) which relates field experiences which might be of help to others engaged in controlled helicopter noise measurements. In each case, the location of a given measurement system is described relative to the helicopter flight path.

5.1 Approach Guidance System - Approach guidance was provided to the pilot by means of a visual approach slope indicator (VASI) and through verbal commands from an observer using a ballon-tracking theodolite. (A picture of the theodolite is included in Figure 3.1, in Section 3.0.) The VASI and theodolite were positioned at the point where the approach path intercepted the ground.

The VASI system used in the test was a 3-light arrangement giving vertical displacement information within ± 0.5 degrees of the reference approach slope. The pilot observed a green light if the helicopter was within 0.5 degrees of the approach slope, red if below the approach slope, white if above. The VASI was adjusted and repositioned to provide a variety of approach angles. A picture of the VASI is included in Figure 3.1, in Section 3.0.

The theodolite system, used in conjunction with the VASI, also provided accurate approach guidance to the pilot. A brief time lag existed between the instant the theodolite observor perceived deviation, transmitted a command, and the pilot made the correction; however, the theodolite crew was generally able to alert the pilot of approach path deviations (slope and lateral displacement) before the helicopter exceeded the limits of the one degree green light of the VASI. Thus, the helicopter only

TABLE 5.1

REFERENCE HELICOPTER ALTITUDES FOR APPROACH TESTS
(all distances expressed in feet)

	MICROPHONE NO. 4	MICROPHONE NO. 1	MICROPHONE NO. 5
APPROACH ANGLE = 3°	A = 8010 B = 420 C = ±70	A = 7518 B = 394 C = ±66	A = 7026 B = 368 C = ±62
6°	A = 4241 B = 446 C = ±37	A = 3749 B = 394 C = ±33	A = 3257 B = 342 C = ±29
9°	A = 2980 B = 472 C = ±27	A = 2488 B = 394 C = ±22	A = 1362 B = 316 C = ±18

A = distance from VASI to microphone location

B = reference helicopter altitude

C = boundary of the 1 degree VASI glide slope "beam width".

occasionally and temporarily deviated more than 0.5 degrees from the reference approach path.

Approach paths of 6 and 9 degrees were used during the test program. Table 5.1 summarizes the VASI beam width at each measurement location for a variety of the approach angles used in this test.

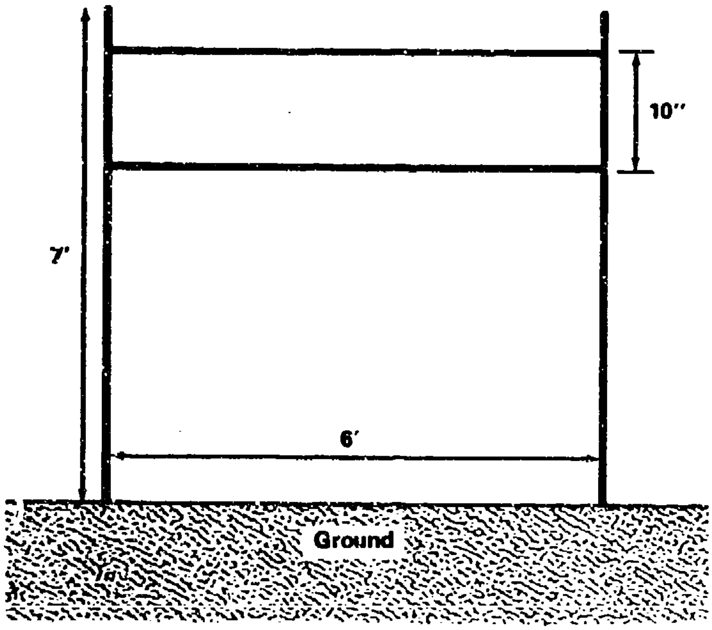
5.2 Photo Altitude Determination Systems - The helicopter altitude over a given microphone was determined by the photographic technique described in the Society of Automotive Engineers report AIR-902 (ref. 1). This technique involves photographing an aircraft during a flyover event and proportionally scaling the resulting image with the known dimensions of the aircraft. The camera is initially calibrated by photographing a test object of known size and distance. Measuring the resulting image enables calculation of the effective focal length from the proportional relationship:

(image length)/(object length)=(effective focal length)/(object distance)

This relationship is used to calculate the slant distance from microphone to aircraft. Effective focal length is determined during camera calibration, object length is determined from the physical dimensions of the aircraft (typically the rotor diameter or fuselage) and the image size is measured on the photograph. These measurements lead to the calculation of object distance, or the slant distance from camera or microphone to aircraft. The concept applies similarly to measuring an image on a print, or measuring a projected image from a slide.

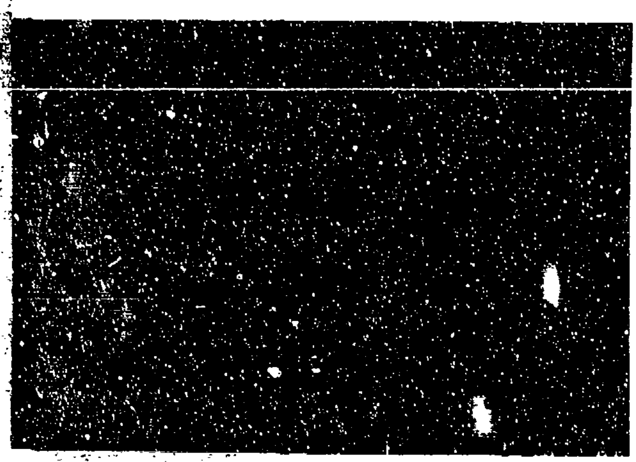
Figure 5.1

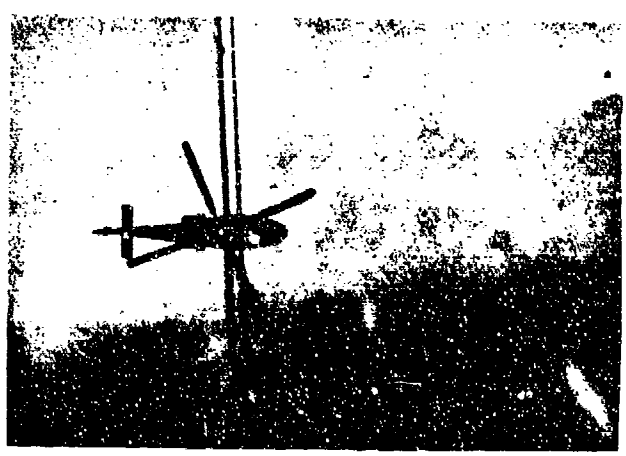
Photo Overhead Positioning System (Pop System)



Artist's Drawing of the Photo Overhead Positioning System (Figure is not to scale.)

Photographer using the POP System to photograph the helicopter.





Photographs of the Aerospatiale Dauphin 2, as taken by the photographer using the POP system.

The SAE AIR-902 technique was implemented during the 1983 helicopter tests with three 35mm single lens reflex (SLR) cameras using slide film. A camera was positioned 100 feet from each of the centerline microphone locations. Lenses with different focal lengths, each individually calibrated, were used in photographing helicopters at differing altitudes in order to more fully "fill the frame" and reduce image measurement error.

The photoscaling technique assumes the aircraft is photographed directly overhead. Although SAE AIR-902 does present equations to account for deviations caused by photographing too soon or late, or by the aircraft deviating from the centerline, these corrections are not required when deviations are small. Typically, most of the deviations were acoustically insignificant. Consequently, corrections were not required for any of the 1983 test photos.

The photographer was aided in estimating when the helicopter was directly overhead by means of a photo-overhead positioning system (POPS) as illustrated in the figure and pictures in Figure 5.1 The POP system consisted of two parallel (to the ground) wires in a vertical plane orthogonal to the flight path. The photographer, lying beneath the POP system, initially positioned the camera to coincide with the vertical plane of the two guide wires. The photographer tracked the approaching helicopter in the viewfinder and tripped the shutter when the helicopter crossed the superimposed wires. This process of tracking the helicopter also minimized image blurring and the consequent elongation of the image of the fuselage.

A scale graduated in 1/32-inch increments was used to measure the projected image. This scaling resolution translated to an error in altitude of less than one percent. A potential error lies in the scaler's interpretation of the edge of the image. In an effort to quantify this error, a test group of ten individuals measured a selection of the fuzziest photographs from the helciopter tests. The resulting statistics revealed that 2/3 of the participants were within two percent of the mean altitude. SAE AIR-902 indicates that the overall photoscaling technique, under even the most extreme conditions, rarely produces error exceeding 12 percent, which is equivalent to a maximum of 1 dB error in corrected sound level data. Actual accuracy varies from photo to photo; however, by using skilled photographers and exercising reasonable care in the measurements, the accuracy is good enough to ignore the resulting small error in altitude.

5.3 Cockpit Photo Data - During each flight operation of the test program, cockpit instrument panel photographs were taken with a 35mm SLR camera, with an 85mm lens, and high speed slide film. These pictures served as verification of the helicopter's speed, altitude, and torque at a particular point during a test event. The photos were intended to be taken when the aircraft was directly over the centerline-center microphone site, site #1 (see Figure 3.3). Although the photos were not always taken at precisely that point, the pictures do represent a typical moment during the test event. The word typical is important because the snapshot freezes instrument readings at one moment in time, while actually the readings are constantly changing by a small amount because of instrument fluctuation and pilot input. Thus, fluctuations above or below reference conditions are to be anticipated. A reproduction of a typical cockpit photo is shown in Figure 5.2. The use of a video tape system is being considered for future tests to acquire a continuous record of cockpit parameters during each data run. Preliminary FAA studies (April 1984) indicate that this technique can be most successful using off the shelf equipment. When slides were projected onto a screen, it was possible to read and record the instrument readings with reasonable accuracy. This data acquisition system was augmented by the presence of an experienced cockpit observor who provided additional documentation of operational parameters.

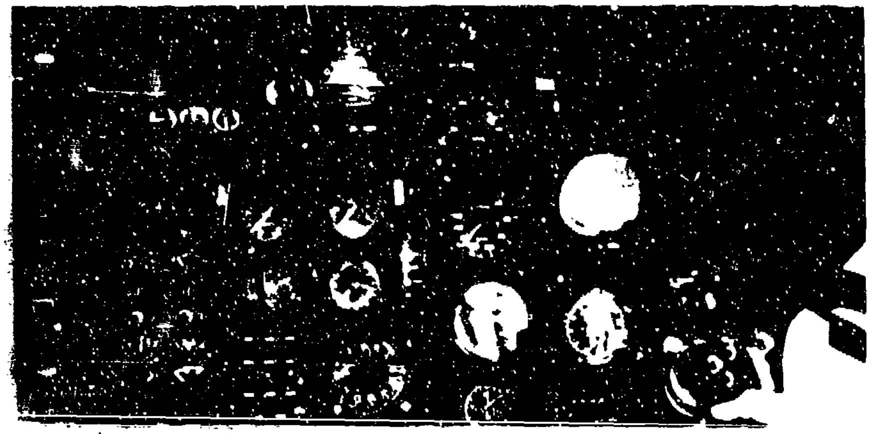


FIGURE 5.2

5.4 <u>Upper Air Meteorological Data Acquisition/NWS: Sterling, VA</u> - The National Weather Service (NWS) at Sterling, Virginia provided upper air meteorological data obtained from balloon-borne radiosondes. These data consisted of pressure, temperature, relative humidity, wind direction, and speed at 100' intervals from ground level through the highest test altitude. The balloons were launched approximately 2 miles north of the measurement array. To slow the ascent rate of the balloon, an inverted parachute was attached to the end of the flight train. The VIZ Accu-Lok (manufacturer) radiosonde employed in these tests consisted of sensors which sampled the ambient temperature, relative humidity, and pressure of the air. Each radiosonde was individually calibrated by the manufacturer. The sensors were coupled to a radio transmitter which emitted an RF signal of 1680 MHz sequentially pulse-modulated at rates corresponding to the values of sampled meteorological parameters. These signals were received by the ground-based tracking system and converted into a continuous trace on a strip chart recorder. The levels were then extracted manually and entered into a minicomputer where calculations were performed. Wind speed and direction were determined from changes in position and direction of the "flight train" as detected by the radiosonde tracking system. Figure 5.3 shows technicians preparing to launch a radiosonde.

FIGURE 5.3

The manufacturer's specifications for accuracy are:

Pressure = ± 4 mb up to 250 mb

Temperature = ± 0.5°C, over a range of +30°C to -30°C

Humidity = ± 5% over a range of ± 25°C to 5°C

The National Weather Service has determined the "operational accuracy" of a radiosonde (as documented in an unpublished report entitled "Standard for Weather Bureau Field Programs", 1-1-67) to be as follows:

Pressure = ± 2 mb, over a range of 1050 - 5 mb

Temperature = ± 1°C, over a range of +50°C to -70°C

Humidity = ± 5% over a range of +40°C to -40°C

The temperature and pressure data are considered accurate enough for general documentary purposes. The relative humidity data are the least reliable. The radiosonde reports lower than actual humidities when the air is near saturation. These inaccuracies are attributable to the slow response time of the humidity sensor to sudden changes. (Ref. 2).

5.5 Surface Meteorological Data Acquisition/NWS: Dulles Airport - The National Weather Service Station at Dulles provided temperature, windspeed, and wind direction on the test day. Readings were noted every 15 minutes. These data are presented in Appendix H. The temperature transducers were located approximately 2.5 miles east of the test site at a height of 6 feet (1.8 m) above the ground, the wind instruments were at a height of 30 feet (10 m) above ground level. The dry bulb thermometer and dew point transducer were contained in the Bristol (manufacturer) HO-61 system operating with $\pm$ one degree accuracy. The windspeed and direction were measured with the Electric Speed Indicator (manufacturer) F420C System, operating with an accuracy of 1 knot and ± 5° (maximum error).

On-site meterological data were also obtained by TSC personnel using a Climatronics (manufacturer) model EWS weather system. The anemometer and temperature sensor were located 10 feet above ground level at noise site 4. These data are presented in Appendix I. The following table identifies the accuracy of the individual components of the EWS system.

Sensor	Accuracy	Range	Time Constant
Windspeed	±.025 mph or 1.5%	0-100 mph	5 sec
Wind Direction	±1.5%	0-360° Mech 0-540° Elect	15 sec
Relative Humidity	±2% 0-100% RH	0-100% RH	10 sec
Temperature	±1.0°F	-40 to +120°F	10 sec

After "detection" (sensing), the meteorological data are recorded on a Rustrak (manufacturer) paperchart recorder. The following table identifies the range and resolutions associated with the recording of each parameter.

Sensor	Range	Chart Resolution
Windspeed	0-25 TSC mod 0-50 mph	±0.5 mph
Wind Direction	0-540°	±5°
Relative Humidity	0-100% RH	±2% RH
Temperature	-40° to 120°F	±1°F

5.6.0 Noise Data Acquisition Sytems/System Deployment - This section provides a detailed description of the acoustical measurement systems employed in the test program along with the deployment plan utilized in each phase of testing.

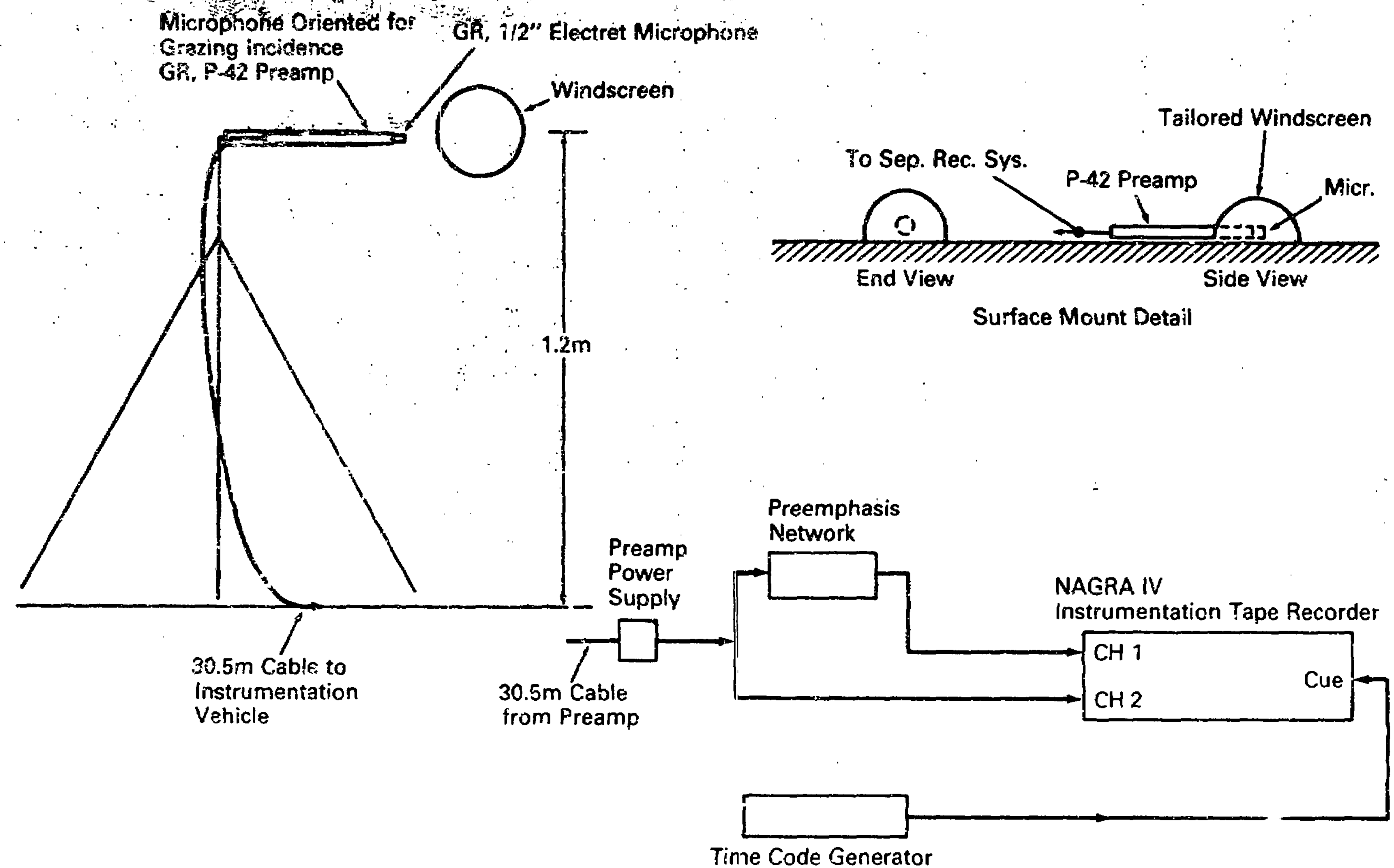
5.6.1 Description of TSC Magnetic Recording Systems - TSC personnel deployed Nagra two-channel direct-mode tape recorders. Noise data were recorded with essentially flat frequency response on one channel. The same input data were weighted and amplified using a high frequency pre-emphasis filter and were recorded on the second channel. The pre-emphasis network rolled off those frequencies below 10,000 Hz at 20 dB per decade. The use of pre-emphasis was necessary in order to boost the high frequency portion of the acoustical signal (such as a helicopter spectrum) characterized by large level differences (30 to 60 dB) between the high and low frequencies. Recording gains were adjusted so that the best possible signal-to-noise ratio would be achieved while allowing enough "head room" to comply with applicable distortion avoidance requirements.

IRIG-B time code synchronized with the tracking time base was recorded on the cue channel of each system. The typical measurement system consisted of a General Radio 1/2 inch electret microphone oriented for grazing incidence driving a General Radio P-42 preamp and mounted at a height of four feet (1.2 meters). A 100-foot (30.5 meters) cable was used between the tripod and the instrumentation vehicle located at the perimeter of the test circle. A schematic of the acoustical instrumentation is shown in Figure 5.4.

Figure 5.4 also shows the cutaway windscreen mounting for the ground microphone. This configuration places the lower edge of the microphone diaphram approximately one-half inch from the plywood (4 ft by 4 ft) surface. The ground microphone was located off center in order to avoid natural mode resonant vibration of the plywood square.

FIGURE 5.4

Acoustical Measurement Instrumentation



5.6.2 FAA Direct Read Measurement Systems - In addition to the recording systems deployed by TSC, four direct read, Type-1 noise measurement systems were deployed at selected sites. Each noise measurement site consisted of an identical microphone-preamplifier system comprised of a General Radio 1/2-inch electret microphone (1962-9610) driving a General Radio P-42 preamplifier mounted 4 feet (1.2m) above the ground and oriented for grazing incidence. Each microphone was covered with a 3-inch windscreen.

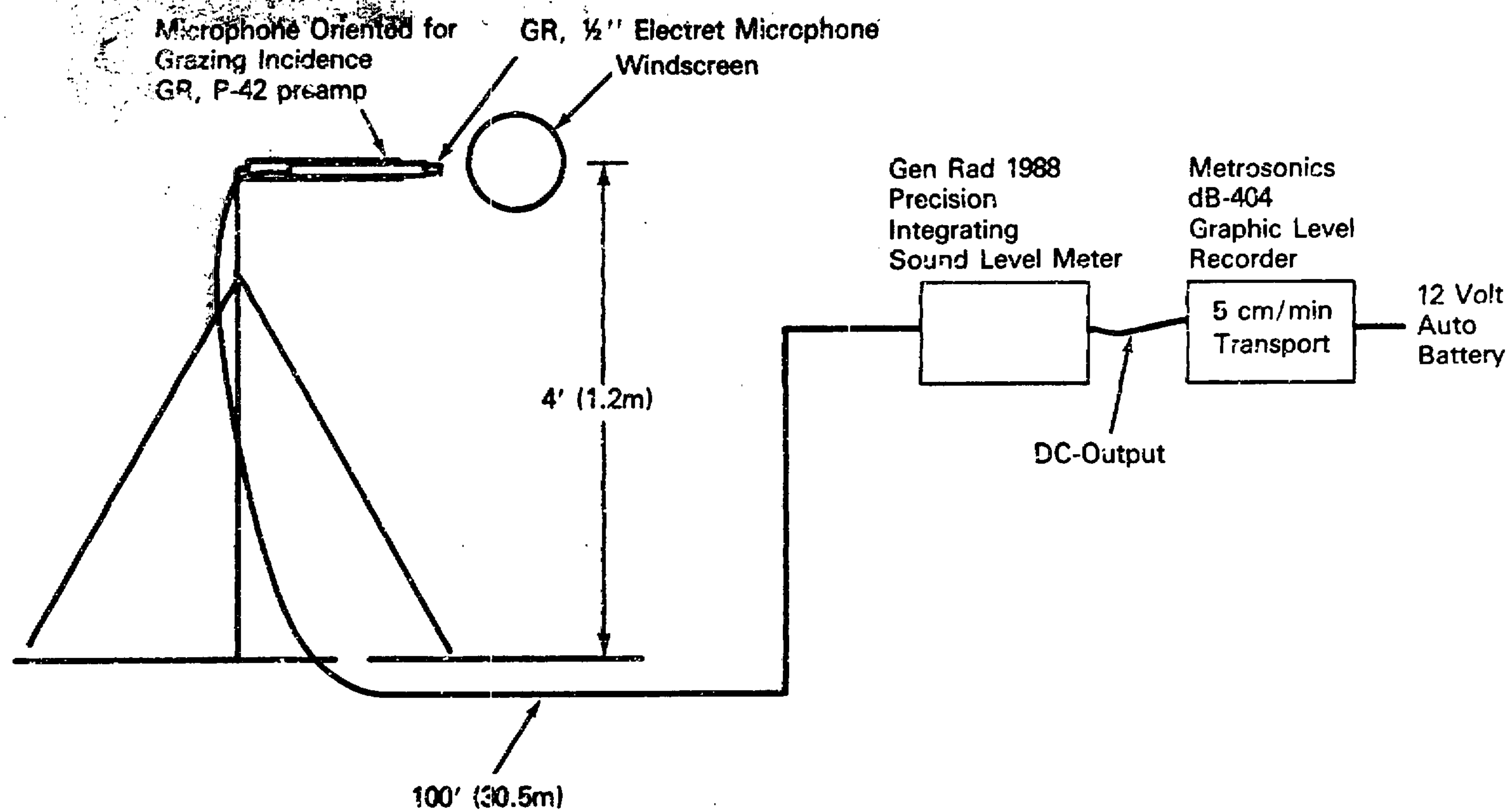
Three of the direct read systems utilized a 100-foot cable connecting the microphone system with a General Radio 1988 Precision Integrating Sound Level Meter (PISLM). In each case, the slow response A-weighted sound level was output to a graphic level recorder (GLR). The GLRs operated at a paper transport speed of 5 centimeters per minute (300 cm/hr). These systems collected single event data consisting of maximum A-weighted Sound Level (AL), Sound Exposure Level (SEL), integration time (T), and equivalent sound level (LEQ).

The fourth microphone system was connected to a General Radio 1981B Sound Level Meter. This meter, used at site 7H for static operations only, provided A-weighted Sound Level values which were processed using a micro sampling technique to determine LEQ.

All instruments were calibrated at the beginning and end of each test day and approximately every hour in between. A schematic drawing of the basic direct read system is shown in Figure 5.5.

FIGURE 5.5

Acoustical Measurement Instrumentation



Direct Read Noise Measurement System

5.6.3 Deployment of Acoustical Measurement Instrumentation - This section describes the deployment of the magnetic tape recording and direct read noise measurement systems.

During the testing, TSC deployed six magnetic tape recording systems. During the flight operations, four of these recording system were located at the three centerline sites: one system at site 4, one at site 5, and two at centerline center with the microphone of one of those systems at 4 feet above ground, the microphone of the other at ground level. The two remaining recording systems were located at the two sidelines sites. The FAA deployed three direct read systems at the three centerline sites during the flight operations. Figure 5.6 provides a schematic drawing of the equipment deployment for the flight operations.

In the case of static operations, only four of the six recorder systems were used. The recorder system with the 4-foot microphone at site 1 moved to site 1H. The recorders at sites 4 and 5 moved to 4H and 5H respectively. The recorder at site 2, the south sideline site, was also used. The three direct read systems were moved from the centerline sites to sites 5H, 2, and 4H. The fourth direct read system was employed at site 7H. Figure 5.7 provides a schematic diagram of the equipment deployment for the static operations.

FIGURE 5.6

Microphone and Acoustical Measurement Instrument Deployment Flight Operations

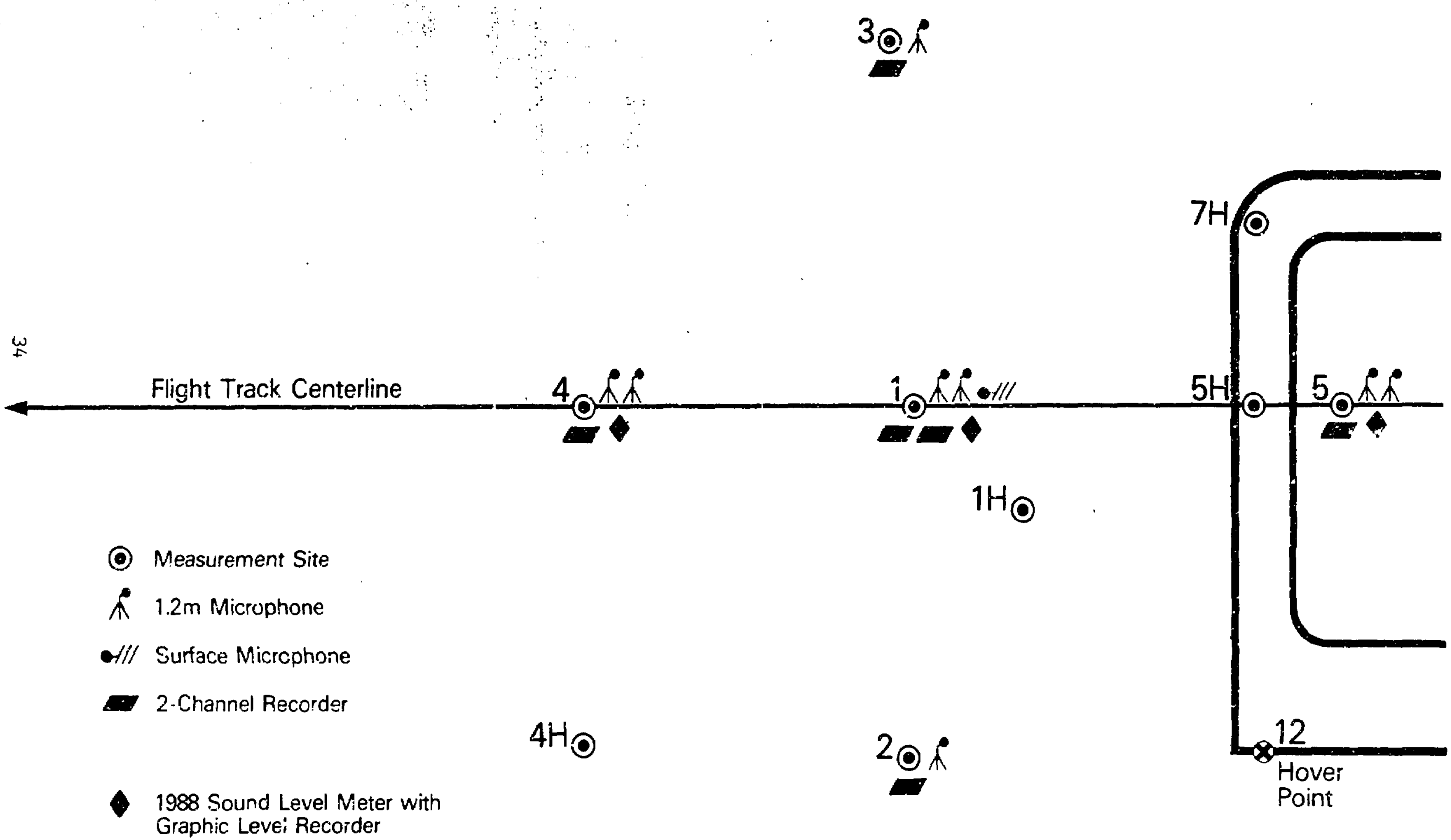
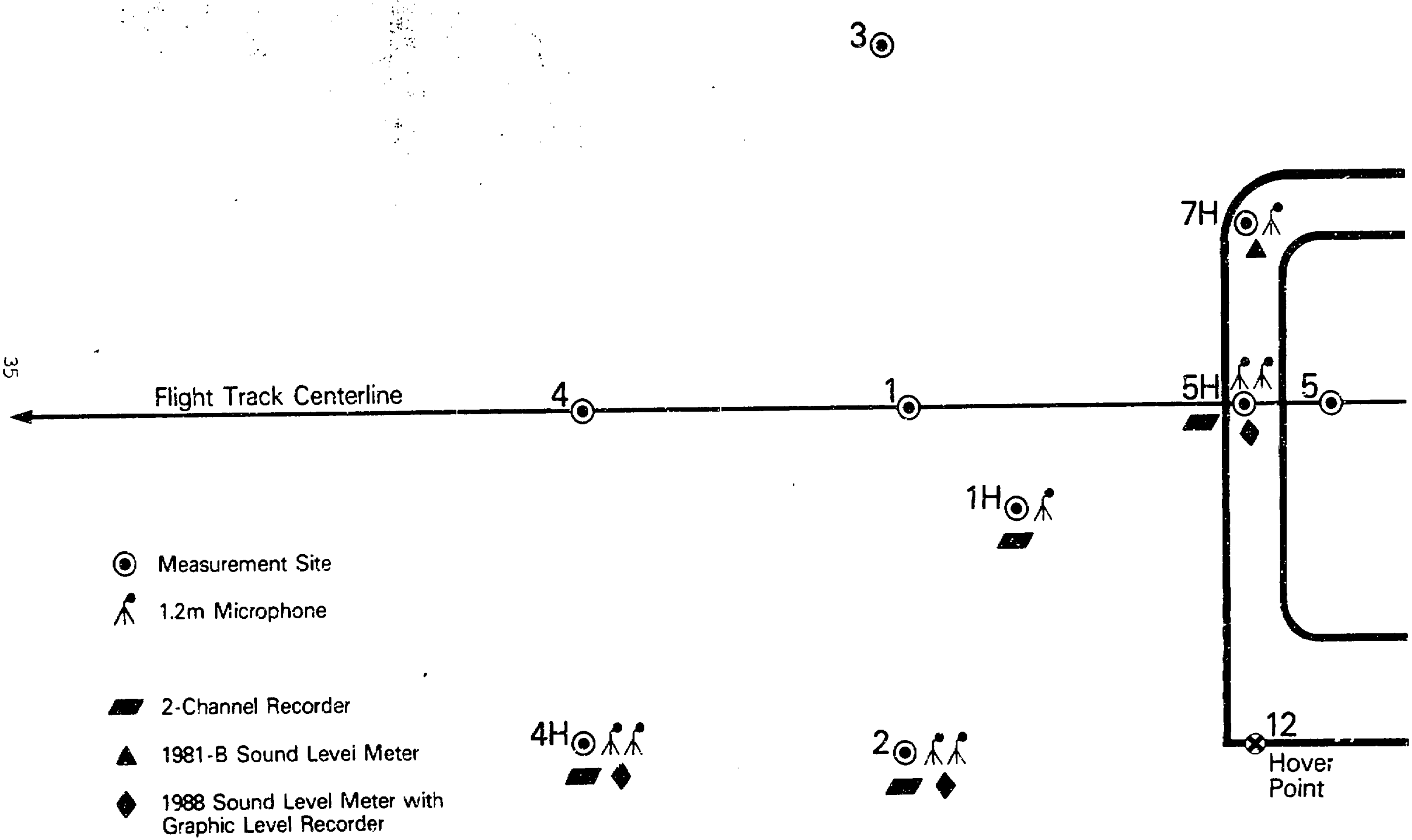


FIGURE 5.7

Microphone and Acoustical Measurement Instrument Deployment Static Operations



ACOUSTICAL DATA REDUCTION

6.0 Acoustical Data Reduction - This section describes the treatment of tape recorded and direct read acoustical data from the point of acquisition to point of entry into the data tables shown in the appendices of this document.

6.1 TSC Magnetic Recording Data Reduction - The analog magnetic tape recordings analyzed at the TSC facility in Cambridge, Massachusetts were fed into magnetic disc storage after filtering and digitizing using the GenRad 1921 one-third octave real-time analyzer. Recording system frequency response adjustments were applied, assuring overall linearity of the recording and reduction system. The stored 24, one-third octave sound pressure levels (SPLs) for contiguous one-half second integration periods making up each event comprise the base of "raw data." Data reduction followed the basic procedures defined in Federal Aviation Regulation (FAR) Part 36 (Ref. 3). The following sections describe the steps involved in arriving at final sound level values.

6.1.1 Ambient Noise - The ambient noise is considered to consist of both the acoustical background noise and the electrical noise of the measurement system. For each event, the ambient level was taken as the five to ten-second time averaged one-third octave band taken immediately prior to the event. The ambient noise was used to correct the measured raw spectral data by substracting the ambient level from the measured noise levels on an energy basis. This substraction yielded the corrected noise level of the aircraft. The following execptions are noted:

1. At one-third octave frequencies of 630 Hz and below, if the measured level was within 3 dB of the ambient level, the measured level was corrected by being set equal to the ambient. If the measured level was less than the ambient level, the measured level was not corrected.

2. At one-third octave frequencies above 630 Hz, if the measured level was within 3 dB or less of the ambient, the level was identified as "masked."

6.1.2 Spectral Shaping - The raw spectral data, corrected for ambient noise, were adjusted by sloping the spectrum shape at -2 dB per one-third octave for those bands (above 1.25 kHz) where the signal to noise ratio was less than 3 dB, i.e., "masked" bands. This procedure was applied in cases involving no more than 9 "masked" one-third octave bands. The shaping of the spectrum over this 9-band range was conducted to minimize EPNL data loss. This spectral shaping methodology deviates from FAR-36 procedures in that the extrapolation includes four more bands than normally allowed.

6.1.3 Analysis System Time Constant/Slow Response - The corrected raw spectral data (contiguous linear 1/2 second records of data) were processed using a sliding window or weighted running logarithmic averaging procedure to achieve the "slow" dynamic response equivalent to the "slow response" characteristic of sound level meters as required under the provisions of FAR-36. The following relationship using four consecutive data records was used:

$$L_i = 10 \text{ Log } [0.13(10.^{0.1L_i-3})+0.21(10.^{0.1L_i-2})+0.27(10.^{0.1L_i-1})+0.39(10.^{0.1L_i})]$$

where L_i is the one-third octave band sound pressure level for the ith one-half second record number.

6.1.4 Bandsharing of Tones - All calculations of PNLTM included testing for the presence of band sharing and adjustment in accordance with the procedures defined in FAR-36, Appendix B, Section B 36.2.3.3, (Ref. 4).

6.1.5 Tone Corrections - Tone corrections were computed using the helicopter acoustical spectrum from 24 Hz to 11,200 Hz, (bands 14 through 40). Tone correction values were computed for bands 17 through 40, the same set of bands used in computing the EPNL and PNLT. The initiation of the tone correction procedure at a lower frequency reflects recognition of the strong low frequency tonal content of helicopter noise. This procedure is in accordance with the requirements of ICAO Annex 16, Appendix 4, paragraph 4.3. (Ref. 5)

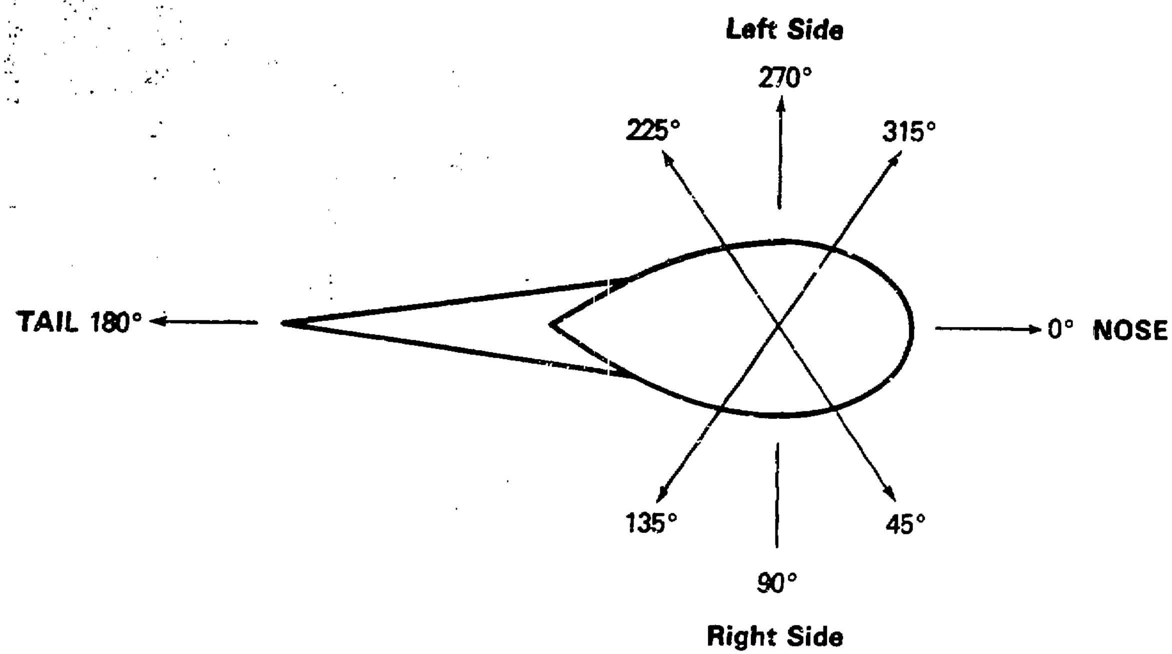
6.1.6 Other Metrics - In addition to the EPNL/PNLT family of metrics and the SEL/AL family, the overall sound pressure level and 10-dB down duration times are presented as part of the "As Measured" data set in Appendix A. Two factors relating to the event time history (distance duration and speed corrections, discussed in a later section) are also presented.

6.1.7 Spectral Data/Static Tests - In the case of static operations, thirty-two seconds of corrected raw spectral data (64 contiguous 1/2 second data records) were energy averaged to produce the data tabulated in Appendix C. The spectral data presented is "as measured" at the emission angles shown in Figure 6.1, established relative to each microphone location. Also included in the tables are the 360 degree (eight emission angles) average levels, calculated by both arithmetic and energy averaging.

Note that "masked" levels (see Section 6.1.1) are replaced in the tables of Appendix C with a dash (-). The indexes shown, however, were calculated with a shaped spectra as per Section 6.1.2.

FIGURE 6.1

Acoustical Emission Angle Convention



6.2 FAA Direct Read Data Reduction - FAA direct read data was reduced using the Apple IIe microcomputer and the VISICALC® software package. VISICALC® is an electronic worksheet composed of 256 x 256 rows and columns which can support mathematical manipulation of the data placed anywhere on the worksheet. This form of computer software lends itself to a variety of data analyses, by means of constructing templates (worksheets constructed for specific purposes). Data files can be constructed to contain a variety of information such as noise data and position data using a file format called DIF (data interchange format).

Data analysis can be performed by loading DIF files onto analysis templates. The output or results can be displayed in a format suitable for inclusion in reports or presentations. Data tables generated using these techniques are contained in Appendices B and D, and are discussed in Section 9.0.

6.2.1 Aircraft Position and Trajectory - A VISICALC® DIF file was created to contain the photo altitude data for each event of each test series for the test conducted. These data were input into a VISICALC® template designated HELO ALT. The template HELO ALT was designed to perform a 3-point regression through the photo altitude data from which estimates of aircraft altitudes could be determined for each microphone location.

6.2.2 Direct Read Noise Data - HELO NOISE was designed to take two VISICALC® DIF files as input. The first contained the "as measured" noise levels SEL and dBA obtained from the FAA direct read systems and the 10-dB duration time obtained from the graphic level recorder strips, for each of the three microphone sites.

The second consisted of the estimates of aircraft altitude over three microphone sites. HELO NOISE performed calculations to determine two figures of merit related to the event duration influences on the SEL energy dose metric. This analysis is described in Section 9.4. All of the available HELO NOISE output templates are presented in Appendix B.

TEST SERIES DESCRIPTION

7.0 Test Series Description - The noise-flight test operations schedule for the Aerospatiale 365N Dauphin consisted of two major parts.

The first part or core test program included the ICAO certification test operations (takeoff, approach, and level flyover) supplemented by level flyovers at various altitudes (at a constant airspeed) and at various airspeeds (at a constant altitude). In addition to the ICAO takeoff operation a second takeoff flight series was included in which takeoffs were initiated from a hover taxi. An alternative approach operation was also included, utilizing a nine degree approach angle to compare with the six degree ICAO approach data.

The second part of the test program consisted of static operations designed to assess helicopter directivity patterns and examine ground-to-ground propagation.

The following paragraphs describe the Dauphin test schedule by "test series", each test series representing a group of similar events. Each noise event is identified by a letter prefix, corresponding to the appropriate test series, followed by a number which represents the numerical sequence of event (i.e., A1, A2, A3, A4, B5, B6,...,etc.). In some cases the actual order of test series may not follow alphabetically, as a D1, D2, D3, D4, E5, E6, E8, H9, H10, H11,... etc.). In the case of static operations the individual events are reported by the acoustical emission angle referenced to each individual microphone location (i.e., J120, J165, J210, J255, J300, J345, J030, J75). In each of the paragraphs below, the "test target" operational parameters are specified. Actual data run parameters are specified in the appendices of this document.

Test Series A: Runs A1 through A10. This series consisted of level flyovers at a target altitude of 500 feet (152.4 meters) above ground level (AGL), at a target airspeed equal to 135 knots, 90 percent of V_h.

Test Series B: Runs B11 through B14. This series consisted of level flyovers at a target altitude of 500 feet AGL (152.4 meters) at a target airspeed of 120 knots, 80 percent of V_h.

Test Series C: Runs C15 through C20. This series consisted of level flyovers at a target altitude of 500 feet AGL (152.4 meters), at a target airspeed of 105 knots, 70 percent of V_h.

Test Series D: Runs D21 through D25. This series consisted of level flyovers at a target altitude of 1000 feet AGL (304.8 meters), at a target airspeed of 135 knots, 90 percent of V_h.

Test Series E: Runs E26 through E33. This test series reflects ICAO certification takeoff test requirements. All takeoff operations wee flown in the 300 degree direction, passing first over site 5, then sites 1 and 4. The airspeed requirement stipulates a constant velocity equal to Vy, which is 75 knots for the Dauphin.

Test Series F: Runs F34 through F36 and F46 through F52. This test series consisted of approach operations flown on a magnetic heading of 120 degrees. The helicopter passed over sites 4, 1, and 5 in succession. This series reflects ICAO operational requirements, which stipulate a six degree approach path at a constant target airspeed of 75 knots (Vy, speed for the best rate of climb).

Test Series G: Runs GA37 through GA40 and runs GB41 through GB46. The GA series consisted of direct climb takeoffs for the best rate of climb from 5-foot hover position. The GB series consisted of takeoffs for the best angle of climb from a 5-foot hover position.

Test Series H: Runs H52 through H56. This test series consisted of 9 degree approaches conducted at a constant target airspeed of 75 knots.

Test Series I: Hover-in-ground effect; skid height approximately five feet above ground level. A one-minute sample of noise data was acquired for each of eight directivity angles.

Test Series J: Flight idle operations; skids on ground. A one-minute noise sample was acquired for each of eight directivity angles.

Test Series K: Hover-out-of-ground effect; skid height approximately 70 feet (21.3 meters). A one-minute sample of noise data was acquired for each of eight directivity angles.

TABLE 7.1

TEST SUMMARY

Test Series	Operational Description
A	500' LFO IAS = 135 KTS
B	500' LFO IAS = 120 KTS
C	500' LFO IAS = 105 KTS
D	1000' LFO IAS = 135 KTS
E	ICAO Takeoff
F	6 Deg ICAO Approach
GA	Direct climb takeoff (Best rate of climb)
GB	Direct climb takeoff (Best angle of climb)
H	9 Deg App IAS = 75 KTS
I	Static (Hover-in-ground effect)
J	Static (Flight Idle)
K	Static (Hover-out-of-ground effect)

8.0 Documentary Analyses/Processing of Trajectory and Meteorological Data - This section contains analyses which were performed to document the flight path trajectory and upper air meteorological characteristics (as a function of time) during the Dauphin test program.

8.1 Photo-Altitude Flight Path Trajectory Analyses - Data acquired from the three centerline photo-altitude sites were processed on an Apple IIe microcomputer using a VISICALC® (manufacturer) electronic spread sheet template developed by the authors for this specific application. The scaled photo-altitudes for each event (from all three photo sites) were entered as a single data set. The template operated on these data, calculating the straight line slope in degrees between the helicopter position over each pair of sites. In addition, a linear regression analysis was performed in order to create a straight line approximation to the actual flight path. This regression line was then used to compute estimated altitudes and CPA's (Closest Point of Approach) referenced to each microphone location (Note: Photo sites were offset from microphone sites by 100 feet). The results of this analysis are contained in the tables of Appendix F.

Discussion - While the photo-altitude data do provide a reasonable description of the helicopter trajectory and provide the means to effect distance corrections to a reference flight path (not implemented in this report), there is the need to exercise caution in interpretation of the data. The following excerpt makes an important point for those trying to relate the descent profiles (in approach test series) to resulting acoustical data.

> In our experience, attempts by the pilot to fly down a very narrow VASI beam produce a continuously varying rate of descent. Thus while the mean flight path is maintained within a reasonable degree of test precision, the rate of descent (important parameter connected with blade/vortex interactions) at any instant in time may vary much more than during operational flying. (Ref. 6)

Further, care is necessary when using the regression slope and the regression estimated altitudes; one must be sure that the site-to-site slopes are similiar (approximate constant angle) and that they are in agreement with the regression slope. If these slopes are not in agreement, then use photo altitude data along with the site-to-site slopes in calculating altitude over microphone locations.

8.2 Upper Air (500-2000 ft) Meteorological Data - This section documents the coarse variation in upper air meteorological parameters as a function of time for the June 6 test program.

The National Weather Service office in Sterling, Virginia provided preliminary data processing resulting in the data tables shown in Appendix H. Supplementary analyses were then undertaken to develop time histories of various parameters over the period of testing for selected altitudes. Each time history was constructed using least square linear regression techniques for the five available data points (one for each launch). The plots attempt to represent the gross (macro) meteorological trends over the test period.

Wind - An examination of the wind data shown in Figures 8.1 and 8.2 shows that at 500 and 1000 feet the cross wind components remained relatively stable, ranging from 6 to 9 knots and gradually decreasing as the day progressed. At the 2000 foot level the wind speed increased from 10 to 15 knots between 5:00am and 9:00am. This, however, would not have affected the flight of the helicopter because operations were conducted below 1100 feet AGL.

During the takeoff operations, between 6:30am and 8:00am, there was a tail wind of 5 to 10 knots at the 500 foot level, which then increased to between 13 and 15 knots at the 1000 foot level. At the 2000 foot level the wind shifted 180 degrees at a strength of approximately 14 knots.

During the approach operations, between 8:00am and 9:00am there was a slight headwind of 4 to 5 knots from ground to 500 feet ALG. The wind increased at the 1000 foot and 2000 foot levels to 12 knots, but at 2000 feet it shifted 180 degrees. This shift in wind direction had no effect on the test as all approach operations were conducted at lower altitudes.

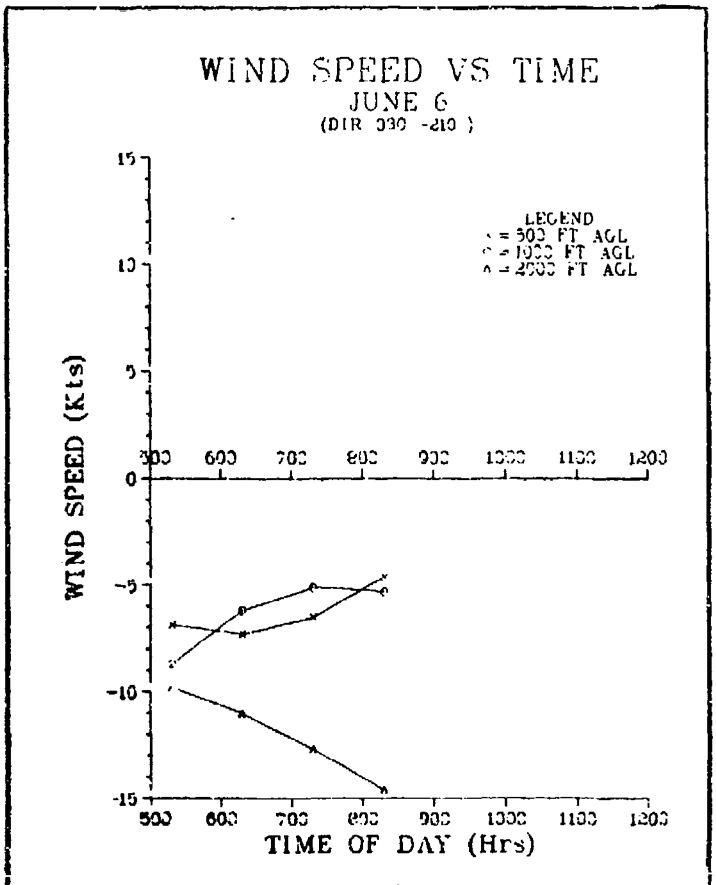


FIGURE 8.1

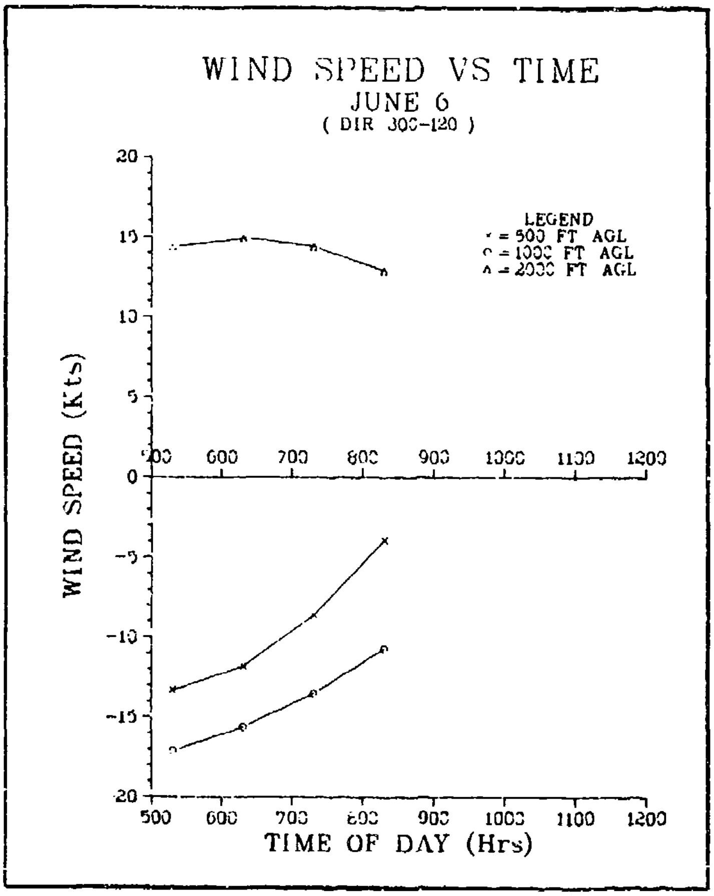


FIGURE 8.2

Temperature - In Figure 8.3, which presents the time history analysis for temperature, one can observe nearly constant temperatures at 1000 and 2000 feet above ground and a gradual warming trend at 500 feet. At ground level there was a gradual increase in temperature between 5:00am and 9:00am, from 13 to 19 degrees C. The plot in Figure 8.3 shows a temperature inversion between the ground and the 1000 foot level which persisted through out the flight operation portion of the test. The strength of the inversion was characterized by a 5° (or less) difference between temperature in the ground and at 500 feet AGL.

Relative Humidity - As shown in Figure 8.4, relative humidity decreased 12% at the 500 foot level between 5:00am and 8:00am. This decrease can be attributed to the burn off of the early morning surface moisture and the dissipation of the inversion layer. During the flight operations the relative humidity remainded at a nearly constant level of 80%.

As shown in ARP-866A, the relative humidity values paired with the temperature values, for the time period of 5:00am to 9:00am, resulted in a 0.2dB correction for the 125Hz frequency band.

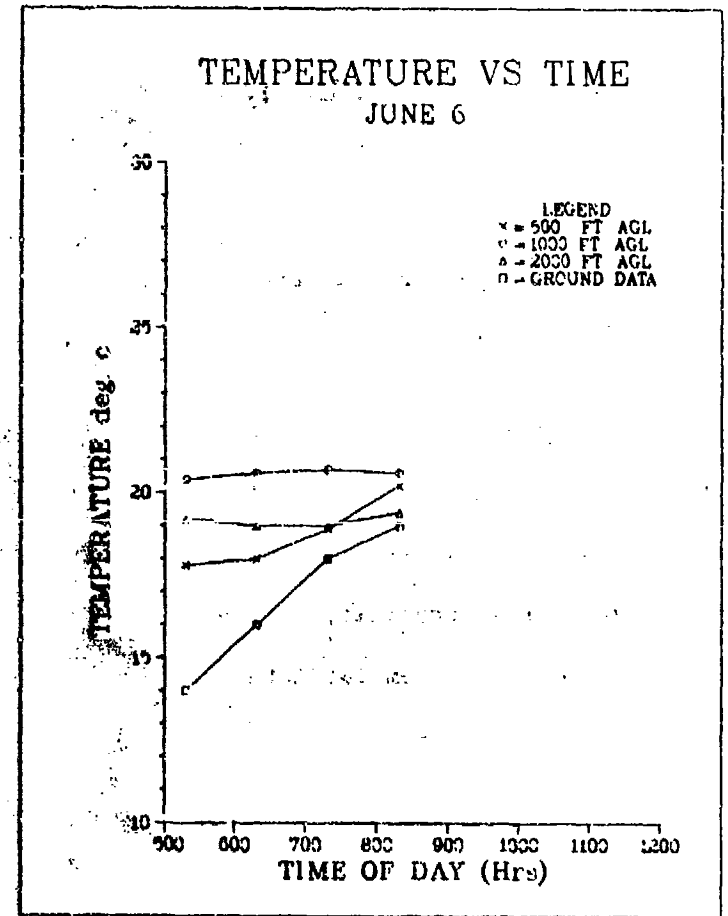


FIGURE 8.3

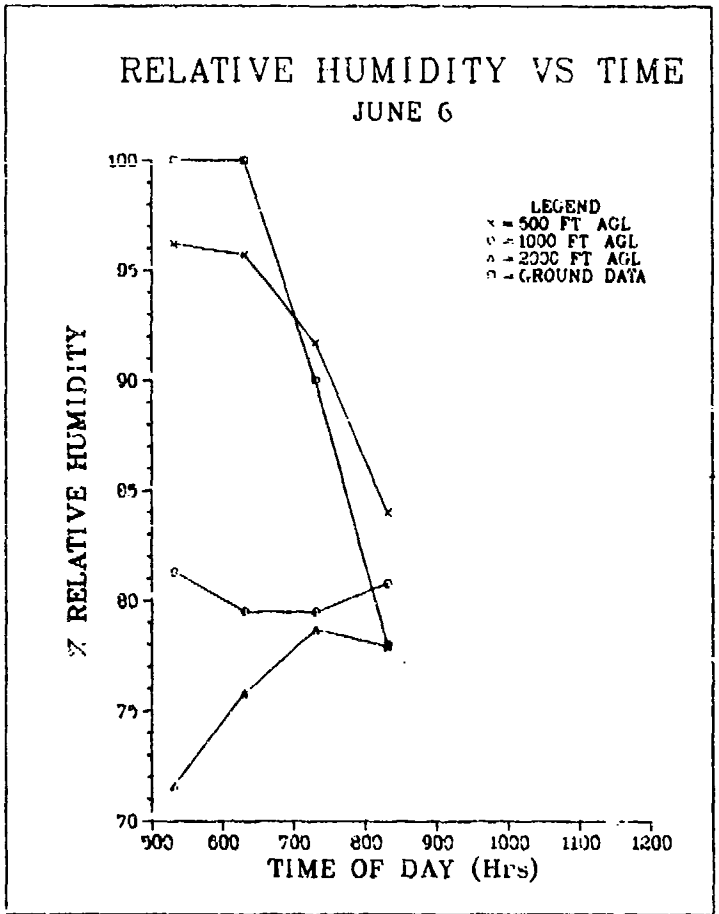


FIGURE 8.4

Discussion - In the context of a noise measurement/flight test one attempts to avoid so-called anomalous meteorological conditions, (see ref. 3) a concept that is difficult to define. In the initial paragraphs of this section, the topic of atmospheric absorption was addressed, concluding with a statement about the apparent stability in values.

Although the reasons behind the requirement to avoid "anomalous conditions" arose from concerns involved with atmospheric absorption, one might extend the requirement to include concerns for smooth flight, and normal attitudinal operation of the helicopter. While extreme cross wind components and/or strong shifts in wind in the vicinity of the test site might suggest the presence of buffeting or turbulance, it is primarily the pilot's reported ease or difficulty in flying the helicopter which identifies a potential problem. While the data do suggest the presence of variation in wind speed and direction, they do not connote an extreme condition which might lead to concern.

As a final note, the influence of wind on blade-vortex interactions (a strong function) cannot be completely addressed using the data presented in this section. Rather, it is necessary to acquire data virtually concurrent with the flight operations and in very close proximity to the test helicopter. It is anticipated that future tests will employ tethered balloon systems deployed in close proximity to the test area.

EXPLORATORY ANALYSES AND DISCUSSIONS

9.0 Exploratory Analyses and Discussion - This section is comprised of a series of distinct and separate analyses of the data acquired with the Aerospatiale Dauphin test helicopter. In each analysis section an introductory discussion is provided describing pre-processing of data (beyond the basic reduction previously described), followed by presentation of either a data table, graph(s), or reference to appropriate appendices. Each section concludes with a discussion of salient results and presentation of conclusions.

The following list identifies the analyses which are contained in this section.

- 9.1 Variation in noise levels with airspeed for level flyover operations
- 9.2 Static data analysis: source directivity and hard vs. soft propagation characteristics
- 9.3 Comparison of noise data: 4-foot vs. ground microphones
- 9.4 Duration effect analysis
- 9.5 Analysis of variability in noise levels for two sites equidistant over similar propagation paths
- 9.6 Variation in noise levels with airspeed and rate of descent for approach operations
- 9.7 Analysis of ground-to-ground acoustical propagation for a nominally soft propagation path
- 9.8 Air-to-ground Acoustical propagation Analysis

9.1 Variation in Noise Levels with Airspeed for Level Flyover Operations - This section analyzes the variation in noise levels for level flyover operations as a function of airspeed. Data acquired from the centerline-center location (site 1) magnetic recording system have been utilized in this analysis. All data are "as measured", uncorrected for the minor variations in altitude from event to event.

The data scatter plotted in Figures 9.1 through 9.4 represent individual noise events for each acoustical metric. The line in each plot links the average observation at each target airspeed.

Discussion - The plots show the general trend that can be expected with an increase in airspeed during level flyover operations. It has been observed that as a helicopter increases its airspeed, two acoustically related events take place. First, the noise event duration is decreased as the helicopter passes more quickly. Second, the source acoustical emission characteristics change. These changes reflect the aerodynamic effects which accompany an increase in speed. At speeds higher than the speed for minimum power, the power required increases with an increase in airspeed. These influences lead to a noise intensity versus airspeed relationship generally approximated by a shallow parabolic curve. A steep upturn in noise level can occur at higher speeds as a consequence of increasing advancing blade tip Mach number effects, which in turn generate impulsive noise.

Noise versus airspeed plots are shown for various acoustical metrics in Figures 9.1 through 9.4. Each of these unremarkable plots display a very weak sensitivity for the range of airspeeds considered. It is likely that the curve would gradually turn upward if higher airspeed data were added.

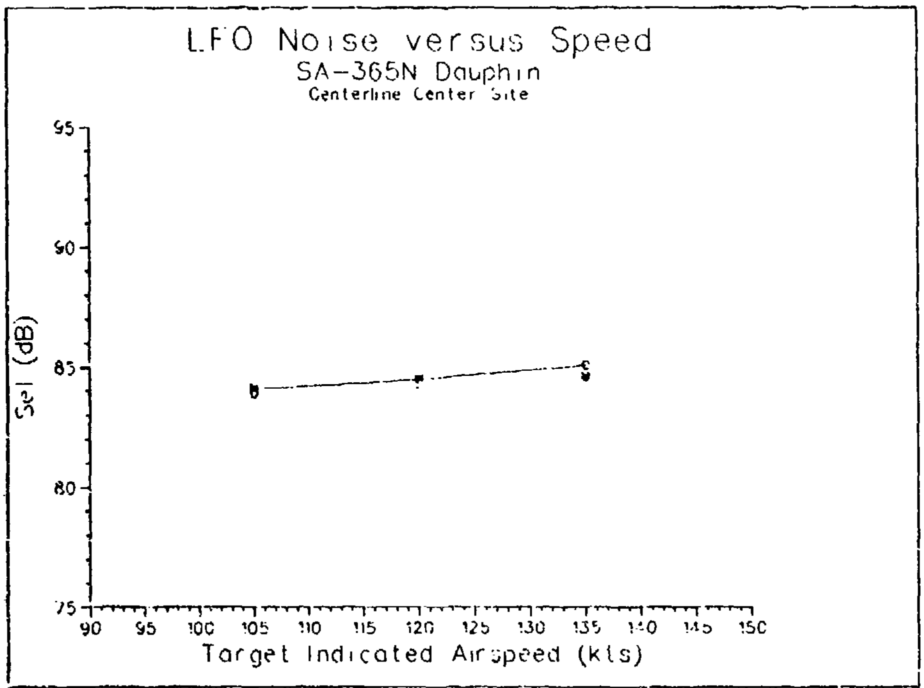


FIGURE 9.1

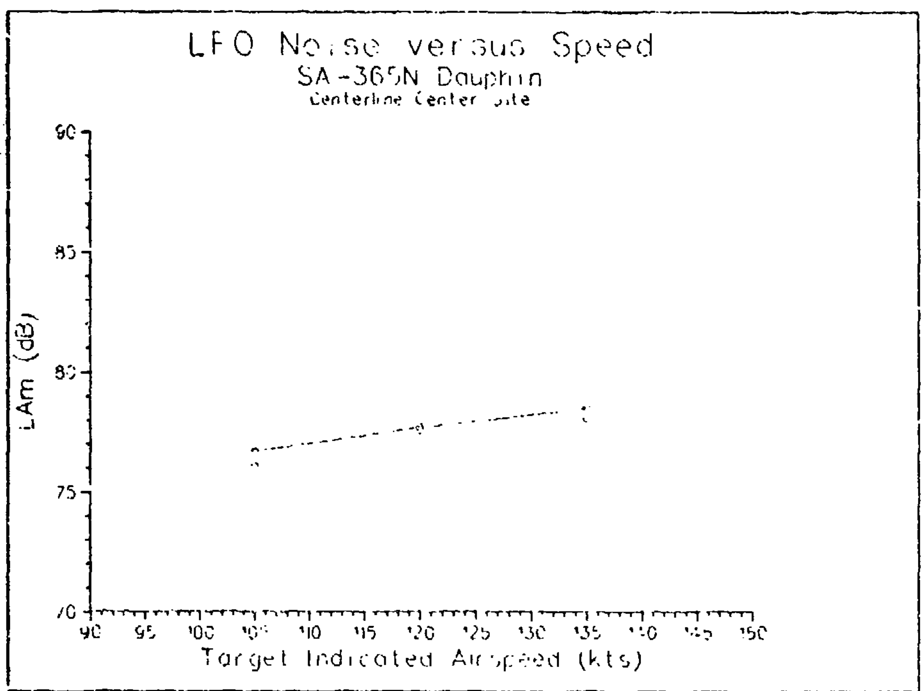


FIGURE 9.2

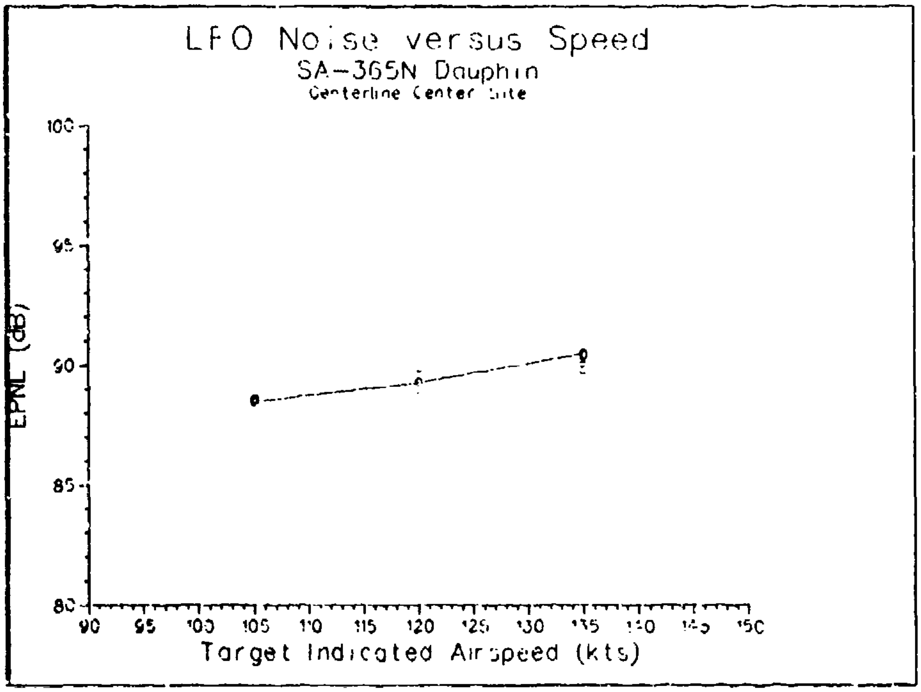


FIGURE 9.3

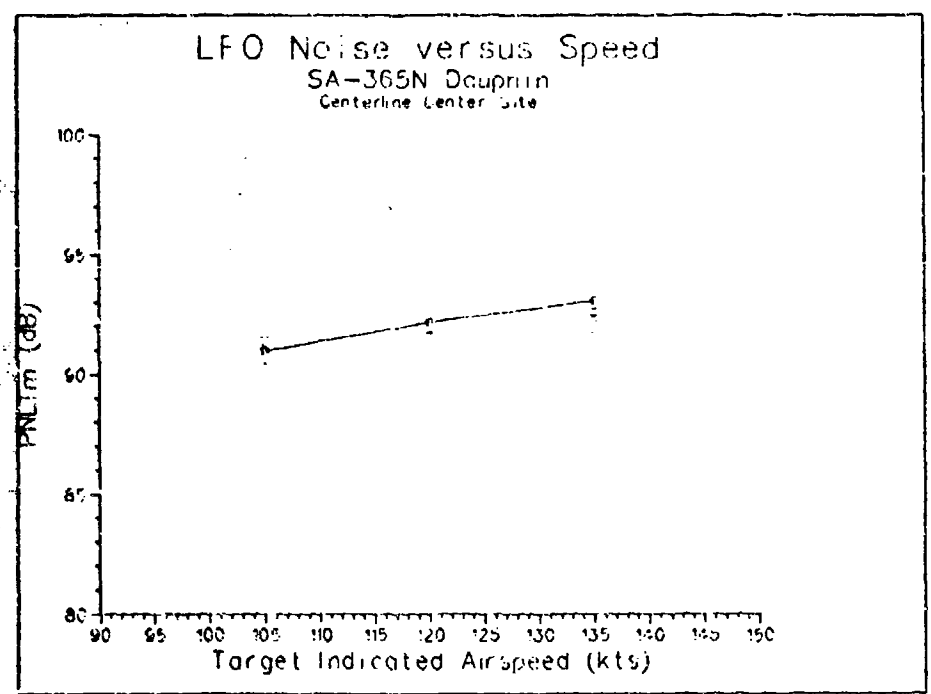


FIGURE 9.4

9.2 Static Operations: Analysis of Source Directivity and Hard vs. Soft Path Propagation Characteristics - This analysis is comprised of two principal components. First, the plots shown in Figures 9.5 through 9.7 depict the time averaged directivity patterns for various static operations for measurement sites located equidistant from the hover point. The second component involves the fact that one of the two sites lies separated from the hover point by a hard asphalt surface, while the other site is separated from the hover point by a soft grassy surface. The difference in the propagation of sound over the two disparate surfaces is reflected in the difference between the upper and lower curves in each plot.

Time averaged (approximately 60 seconds) data are shown for acoustical emission directivity angles (see Figure 6.1) established every 45 degrees from the nose of the helicopter (zero degrees), in a clockwise fashion. Data plotted in these figures can be found in Appendix C for microphones 5H and 2.

Discussion - The plots contained in this analysis dramatically portray the directive nature of the Aerospatiale Dauphin acoustical radiation pattern for static operations. Further, this analysis reveals a spacially averaged difference of 3 to 6 dB in sound levels for sites located 500 feet from a helipad, with one site over a soft surface and the other over a hard surface. Another significant observation is the marked dip observed in the radiation pattern off the right side of the helicopter. In each case discussed below, observations concerning noise impact and acceptability are based on consideration of typical urban/community ambient noise levels and the levels of urban transportation noise sources.

In general, the interpretation of environmental impact requires careful consideration of the ambient sound levels in the vicinity of the specific heliport under consideration.

Discussion: Hover in Ground Effect (HIGE) - The HIGE data plot, Figure 9.5, shows the marked left side directivity pattern mentioned above. The sound level values, in the upper to mid 70's for the hard path (at 500 feet), can in some situations (especially with long duration) present an environmental noise problem. On the other hand, the soft path values range in the low to mid 70's, values which may also be of concern in a quiet urban environment. The point is that there exists a significant advantage in situating a heliport in a location where noise sensitive areas are separated from the heliport by an acoustically absorbent surface such as grass.

Discussion: Hover Out of Ground Effect (HOGE) - The comments made above certainly apply as well in the case of HOGE, a transitional flight regime, shown in Figure 9.6. A mitigating consideration, however, is that the sound levels (AL) in the vicinity of 80 to 85 dB are invariably of the short duration generally associated with ingress/egress operations. These levels are likely to be perceived above other transient transportation noise sounds.

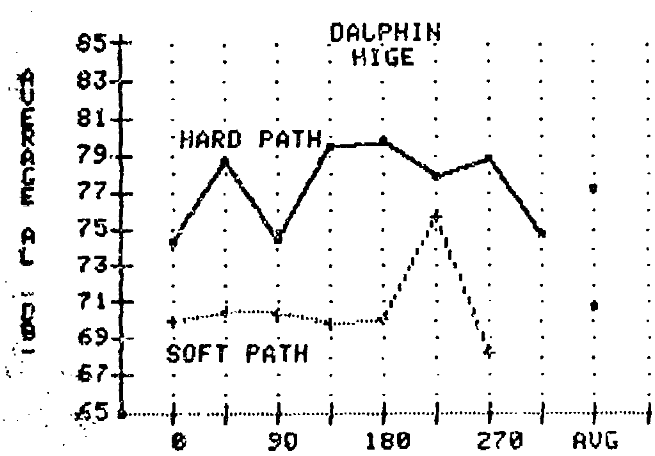


FIGURE 9.5

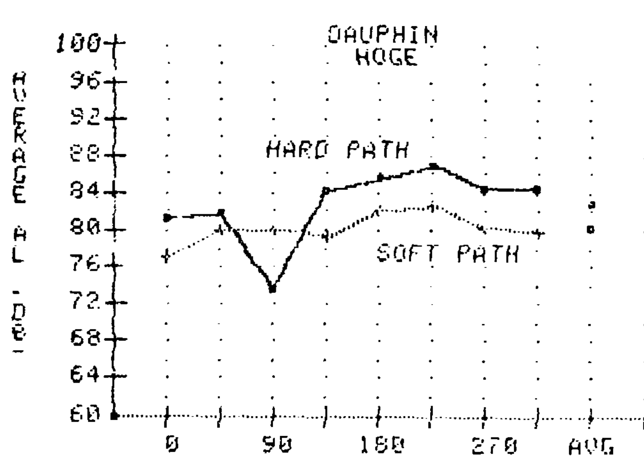


FIGURE 9.6

Discussion: Flight Idle (FI) - Noise data for the flight idle operations are shown in Figure 9.7. As discussed in the case of HIGE, the hard path scenario could pose minor concern in certain urban residential situations.

In all of the cases examined in this analysis, it is evident that ground surface characteristics play a very significant role in ground-to-ground propagation of sound in the vicinity of a heliport.

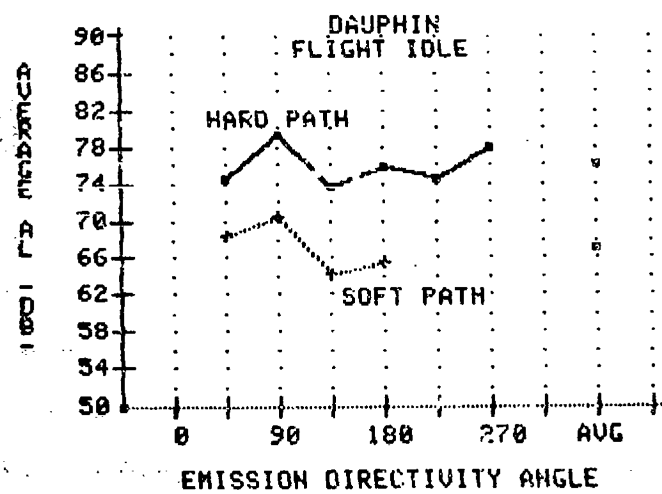


FIGURE 9.7

9.3 Comparison of Measured Sound Levels: 4 Foot vs. Ground Microphones - This analysis addresses the comparability of noise levels measured at different heights above the ground surface. The topic is discussed in the context of noise certification testing requirements. The analysis involves examination of differences between noise levels acquired for ground mounted and 4-ft mounted microphone systems. The objectives of this analysis are as follows: 1) observe the value and variability of ground/4-ft microphone differences and identify the degree of phase coherence and 2) examine the variation with operational configuration.

The data employed in this analysis are from microphone site #1, using TSC magnetic recordings (Appendix A). The mean differences between the ground and four foot microphones are shown in Table 9.1 for nine different test series.

In conducting this analysis, our initial assumption was that the ground-mounted microphone experiences phase coherent pressure doubling (a reasonable assumption at the frequencies of interest). At the 4-foot microphone, one would expect to see a lower value, somewhere within the range of 0 to 3 dB, depending on the degree of random verses coherent phase between incident and reflected sound waves. It is also possible to experience phase cancellation between the two sound paths. If cancellation occurs at dominant frequencies, then one is likely to observe noise levels at the 4-foot microphone more than 3 dB below the ground microphone values. In fact, significant cancellation is observed with instances of 5 to 6 dB (weighted metric) lower levels at the 4-foot microphone.

Discussion - It is argued that acquisition of data from ground-mounted microphónes provides a cleaner spectrum, closer to the spectrum actually emitted by the helicopter--that is, not influenced by a mixture of constructive and destructive ground reflections. Theoretically, one would be interested in correcting ground-based data to levels expected at 4 feet or vice versa in order to maintain equally stringent regulatory policy. In other words, to change a certification limit at a 4-ft. microphone to fit a ground-based microphone test, one theoretically would have to increase the limit by an amount necessary to maintain equal stringency.

Examination of the results in Table 9.1 show that most differences do fall between 3 and 5 dB, with some differences on the order of 6 dB. These results are consistent with theory and suggest that a degree of cancellation typically accompanies the 3dB difference one would expect from consideration of phase relationships.

The variability in test results between operational modes displays no clear pattern. The variation in difference in values can be considered to reflect differences in the "acoustical angle" or the angle of incidence at the time of maximum noise. These geometrical factors are also goined by differences in spectral content in influencing resulting sound level values.

HELICOPTER: DAUPHIN

TABLE 9.1

COMPARISON OF

GROUND AND 4 FT. (1.2 M) MICROPHONE DATA

TEST SERIES	OPERATION	SAMPLE SIZE	TARGET IAS (KTS)	DELTA dB = (GND MIC.) minus (4 FT. MIC.)			
				SEL	AL	EPNL	PNLTM
A	500' LFO	8	135	5	4.6	5.7	5.5
B	500' LFO	4	120	4.8	4.2	5.3	4.9
C	500' LFO	6	105	4.8	4.1	5.2	4.3
D	1000' LFO	5	135	3.8	4.7	6.5	5.1
E	ICAO T/O	8	75	4.5	3.9	4.5	4
F	ICAO APP	8	75	NA	NA	NA	NA
GA	TAKEOFF	4	75	5	4.5	5.1	4.5
GB	TAKEOFF	5	75	3.4	2.3	3.7	5.7
H	9 DEG APP	5	75	NA	NA	NA	NA
		WEIGHTED AVERAGE		4.8	4	5.1	4.8

9.4 Analysis of Duration Effects - This analysis explores the relationship between the helicopter noise event (intensity) time-history, the maximum intensity, and the total acoustical energy of the event. Our interests in this endeavor include the following:

1) It is often necessary to estimate an acoustical metric given only part of the information required.

2) The time history duration is related to the ground speed and altitude of a helicopter. Thus any data adjustments for different altitudes and speeds will affect duration time and consequently the SEL (energy metric). The requirement to adjust data for these effects often arise in environmental impact analysis around heliports. In addition, the need to implement data corrections in helicopter noise certification tests further warrants the study of duration effects.

Two different approaches have been utilized in analyzing the effect of event 10-dB-down duration on the accumulated energy dose (Sound Exposure Level).

Both techniques are empirical, each employing the same input data but using a different theoretical approach to describe duration influences.

The fundamental question one may ask is "If we know the maximum A-weighted sound level and we know the 10-dB-down duration time, can we with confidence estimate the acoustical energy dose, the Sound Exposure Level?" A rephrasing of this question might be: If we know the SEL, the AL, and the 10-dB-down duration time (DURATION), can we construct a universal relationship linking all three?

Both attempts to establish relationships involve taking the difference between the SEL and AL (delta), placing the delta on the left side of the equation and solving as a function of duration. The form which this function takes represents the differences in approach.

In the first case, one assumes that delta equals some constant K(DUR) multiplied by the base 10 logarithm of DURATION, i.e.,

$$SEL - AL = K(DUR) \times LOG(DURATION)$$

In the second case, we retain the 10 x LOG dependency, consistent with theory, while achieving the equality through the shape factor, Q, which is some value less than unity i.e., SEL-AL = 10 x LOG(Q X DURATION). In a situation where the flyover noise event time history was represented by a step function or square wave shape, we would expect to see a value of Q equaling precisely one. However, we know that the time history for typical non-impulsive event is much closer in shape to an isoceles triangle and consequently likely to have a Q much closer to 0.5

Through investigating the characteristics of the shape factor, that is, the variation in Q with ground speed and distance (i.e., Duration) one may be able to derive the expression for the aggregate acoustical radiation pattern such as dipole where $Q=\pi/2$, quadrupole where $Q=\pi/4$, or monopole where $Q=\pi$. This can be determined by solving the relationship between Q and the ratio (π/J), where J is the value which determines the radiation pattern.

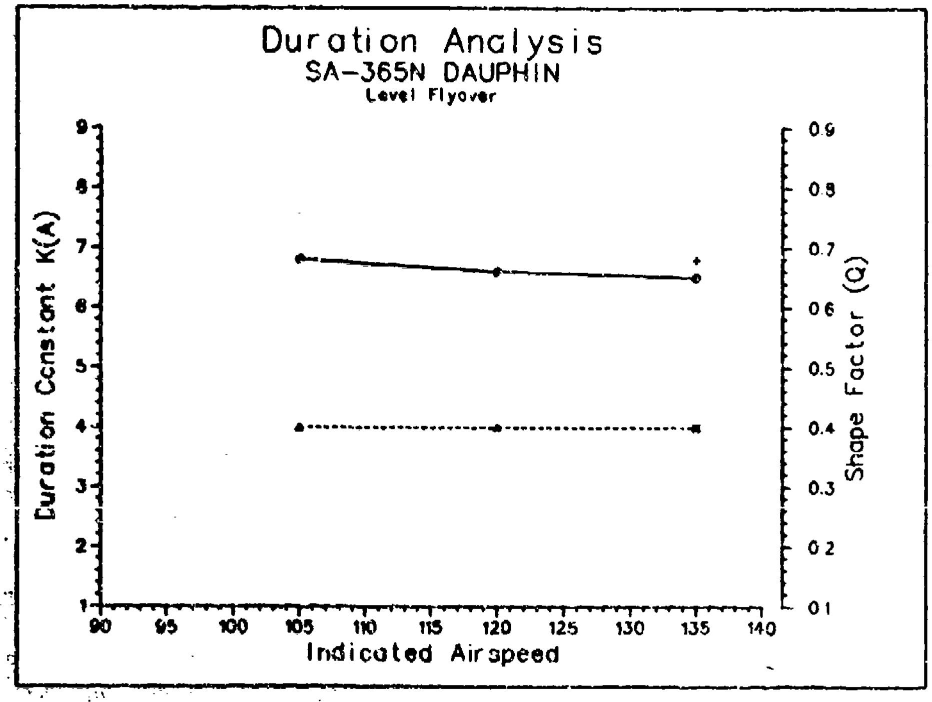
Another possible use of this analytical approach for the assessment of duration effects is in correcting noise certification test data which were acquired under conditions of nonstandard ground speed and/or distance.

Discussion - Each of the noise template data tables lists both of the duration related figures of merit for each individual event (see Appendix B). One immediate observation is the apparent insensitivity of the metrics to changes in operation, and the extremely small variation in the range of metric values, nearly a constant Q = 0.4 and a stable K(A) value of 7.0. Data have been plotted in Figure 9.8 which show the minor variation of both metrics with airspeed for the level flyover operational configurations for the microphone site 1 direct read system. The lack of variation in the parameters suggests that a simple and nearly constant dependency exists between SEL, AL, and log DURATION, relatively unaffected by changes in airspeed, in turn suggesting a consistent time history shape for the range of airspeeds evaluated in this test. As SEL increases with airspeed, the increase appears to be related to increase in AL_M but mitigated in part by reduced duration time (and a nearly constant K=7).

It is interesting to note that similar results were found for the Bell 222 helicopter, suggesting that different helicopter models will have similar values for K and Q. This implies that it would be unnecessary to develop unique constants for different helicopter models for use in implementing duration corrections.

As mentioned above, it is possible to establish an empirical aggregate acoustical radiation pattern by examining the relationship between Q and the ratio Π/J where J reflects the geometric nature of the radiation pattern. The term empirical aggregate is used in acknowledging the multi-component characteristics of acoustical radiation from rotating airfoils. While the constant J may be of limited use in detailed, first-principal predictive acoustics, there may be uses in many semi-empirical engineering applications. As is evident, the value of J ($J = \Pi/Q$) determined from this empirical analysis is approximately 8.

FIGURE 9.8



<u>Legend</u>

o K (A) 500 ft.
Δ Q 500 ft.
+ K (A) 1000 ft.
× Q 1000 ft.

9.5 Analysis of Variability in Noise Levels for Two Sites Over Similiar Propagation Paths - This analysis examines the differences in noise levels observed for two sites each located 500 feet away from the hover point over similar terrain. The objective of the analysis was to examine variability in noise levels associated with ground-to-ground propagation over nominally similar propagation paths. The key word in the last sentence was nominally,...in fact the only difference in the propagation paths is that microphone 1H is located in a slight depression, (elevation is minus 2.5 feet relative to the hover point), while site 2 has an elevation of plus 0.2 feet relative to the hover point. This is a net difference of 2.7 feet over a distance of 500 feet. This configuration serves to demonstrate the sensitivity of ground-to-ground sound propagation over minor terrain variations.

Discussion - The results presented in Table 9.2, 9.3, and 9.4 show the observed differences in time average noise levels for eight directivity angles and the spacial average. It is observed that significant differences in noise level occur for the low angle (ground-to-ground) propagation scenarios while the higher angle operation (HOGE - helicopter 30 feet above ground level) reveals a difference of less than 1 dB. It may be concluded that very minor variations in site elevation may lead to differences in the measured noise levels for static operations.

It is also appropriate to acknowledge possible variation in the acoustical source characteristics. In this analysis, data from microphone site 2 are compared with data recorded at site 1H approximately one minute later. That is, the helicopter rotated 45 degrees every sixty seconds, in order to project each directivity angle; there is a 45 degree separation between the two sites. In addition to source variation, it is also possible that the helicopter "aim," based on magnetic compass readings may have been slightly different in each case, resulting in the projection of different intensities and accounting for the observed differences. A final item of consideration is the possibility of shadowing and refraction, discussed in following sections. It is worth noting that the same general trends--similar results for HOGE, disparate results for HIGE and Flight Idle--were observed in the test results for the Bell 222 (ref. 8). Regardless of what the mechanisms are which create this variance, one can agree that static operations display sound levels intrinsically variant in both direction and time, and also potentially variant (all other factors being normalized) over two nominally identical propagation paths.

TABLE 9.2

COMPARISON OF
NOISE VERSUS DIRECTIVITY ANGLES
FOR
TWO SOFT SURFACES

OPERATION: HOVER-IN-GROUND

	DIRECTIVITY ANGLES (DEGREES)								Lav(360 DEGREE)	
SITE	0	45	90	135	180	225	270	315	ENERGY	ARITH.
	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ
SOFT 1H	70	70.5	70.4	69.8	70.1	75.7	68.2	NA	71.3	70.7
SOFT 2	73.3	76.2	76.8	75.1	82	NA	NA	73.7	NA	76.2
DELTA dB	-3.3	-5.7	-6.4	-5.3	-11.9	NA	NA	NA	NA	-5.5

* DELTA dB = (SITE 1H) minus (SITE 2)

** SITE 1H DATA FROM MAGNETIC RECORDING SYSTEM; SITE 2 DATA FROM DIRECT READ SYSTEM.

Note: All data represent mean values for sample periods of approximately 40 to 60 seconds.

TABLE 9.3

OPERATION: HOVER-OUT-OF-GROUND

	DIRECTIVITY ANGLES (DEGREES)								Lav(360 DEGREE)	
SITE	0	45	90	135	180	225	270	315	ENERGY	ARITH.
	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ
SOFT 1H	77.8	79.8	79.4	79	82.8	81	82.1	78.3	80.3	90
SOFT 2	77.2	79.9	80.1	79.3	82.2	82.6	80.3	79.7	80.4	80.2
DELTA dB	.6	-.1	-.7	-.3	.6	-1.6	1.8	-1.4	-.1	-.2

*DELTA DB = (SITE 1H) MINUS (SITE 2)

** SITE 1H AND SITE 2 DATA FROM MAGNETIC RECORDING SYSTEM.

Note: All data represent mean values for sample periods of approximately 40 to 60 seconds.

TABLE 9.4

OPERATION: FLIGHT IDLE

	DIRECTIVITY ANGLES (DEGREES)								Lav(360 DEGREE)	
SITE	0	45	90	135	180	225	270	315	ENERGY	ARITH.
	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ
SOFT 1H	66.4	NA	71.9	64.5	67.2	66.3	NA	72.3	69.1	68.1
SOFT 2	69.9	NA	70.4	69	65	73.4	78	78.1	NA	72
DELTA dB	-3.5	NA	1.5	-4.5	2.2	-7.1	NA	-5.8	NA	-3.9

* DELTA dB = (SITE 1H) minus (SITE 2)

** SITE 1H DATA FROM MAGNETIC RECORDING SYSTEM; SITE 2 DATA FROM DIRECT READ SYSTEM.

Note: All data represent mean values for sample periods of approximately 40 to 60 seconds.

9.6 Variation in Noise Levels With Airspeed for 6 and 9 Degree Approach Operations - This section examines the variation in noise level between 6 and 9 degree approach operations. The appropriate series "As Measured" acoustical data contained in Appendix A, have been tabulated in Table 9.5 and plotted (corrected for the minor differences in altitude) in Figure 9.9. The objective in conducting this analysis is twofold: first, to evaluate further the realm of "Fly Neighborly" operating possibilities, and second, to consider whether or not it is reasonable to establish a range of approach operating conditions as allowable in a noise certification testing.

Discussion - In the approach operational mode, impulsive (banging or slapping) acoustical signatures are a result of the interaction between vortices (generated by the fundamental rotor blade action) colliding with successive sweeps of the rotor blades (see Figure 9.10). As reported in reference 7, for certain helicopters, maximum interaction occurs at airspeeds in the 50 to 70 knot range, at rates-of-descent ranging from 200 to 400 feet per minute. When the rotor blade enters the vortex region, it experiences local pressure fluctuations and associated changes in blade loading. These perturbations and resulting pressure gradients generate the characteristic impulsive signature.

TABLE 9.5

Variations in 6 and 9 Degree
Approach Operations

APPROACH ANGLE	SITE 5 AVERAGE L_A	SITE 1 AVERAGE L_A	SITE 4 AVERAGE L_A
6° As measured	87.5	85.6	84.3
9° As measured	89.8	84.8	81.8
9°* Adjusted	68.8	85.5	83.1

*Average L_A for 9 degree approach adjusted for difference in altitude between the 6 and 9 degree approaches.

The data presented in Figure 9.9 portray the variation in noise level along the ground track as the approach angle changes (with airspeed held nominally constant). There appears to be a marked but small change in noise level for the operations examined. It is noted that a more exhaustive series of testing which would include 5 or 6 airspeeds for each approach angle would be necessary to establish definitively the potential benefit of "Fly Neighborly" approach procedures.

The other significant observation involves the classic problem of improving the situation at one point while making things worse at another. This is the case with 9 degree approach--marginally quieter (-1 dB) at one point and marginally louder (+1.5 dB) at another point, relative to the 6 degree approach. While the 1 to 2 dB differences are of little concern, the potential for big improvement and simultaneous derogation (in noise level) must be considered when developing an effective "Fly Neighborly" program.

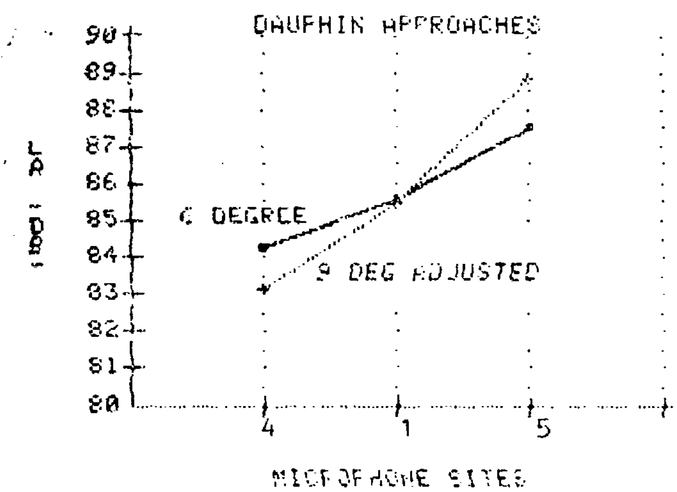
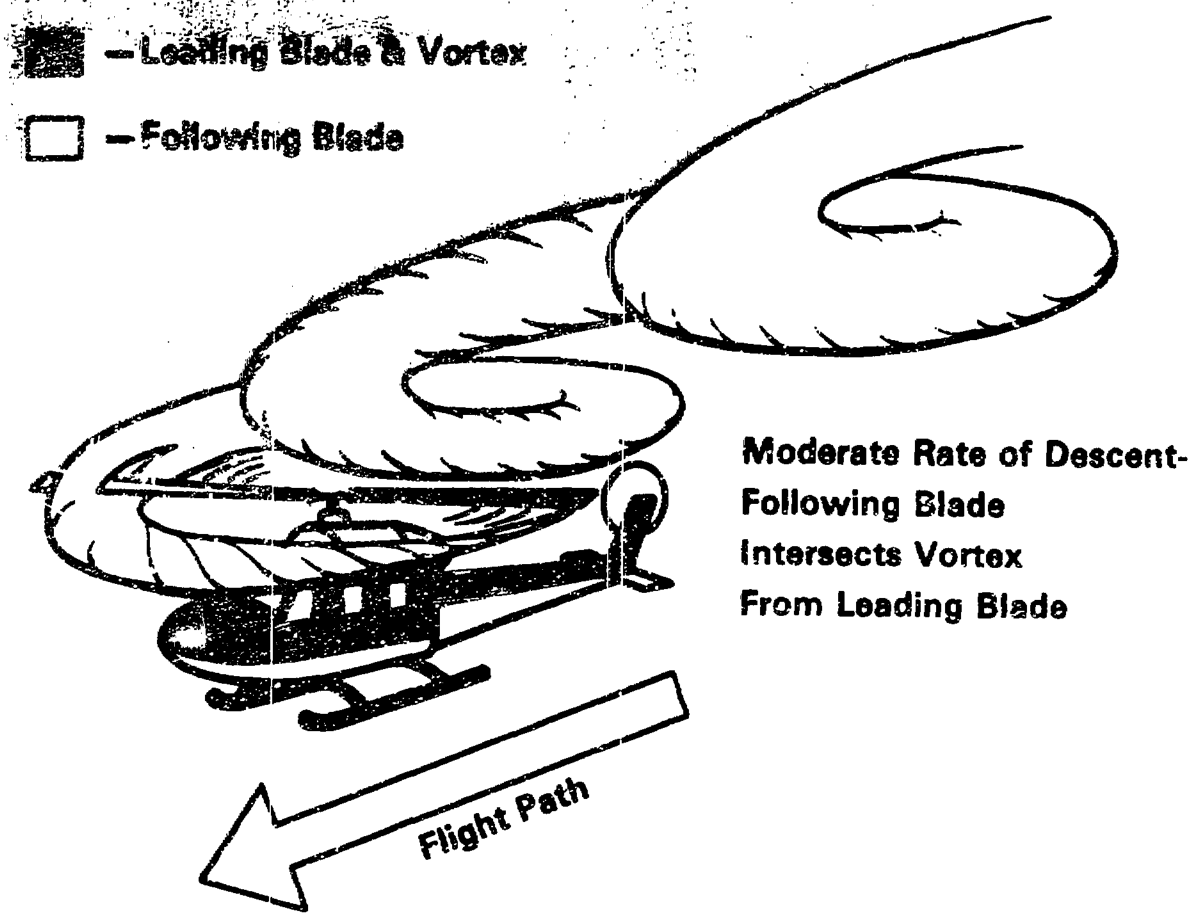


FIGURE 9.9

FIGURE 9.10

Tip Vortex Interaction



9.7 Analysis of Ground-to-Ground Acoustical Propagation for a Nominally Soft Propagation Path - This analysis involves the empirical derivation of propagation constants for a nominally level, "soft" path, a ground surface composed of mixed grasses. As discussed in previous analyses, the several physical phenomena involved in the diminution of sound over distance makes it necessary to draw upon all pertinent theory to explain the various results obtained.

A-weighted Leq data for the three static operational modes HIGE, HOGE, and Flight Idle, have been analyzed in each case for eight different directivity angles. Direct read acoustical data from sites 2 and 4H have been used to calculate the propagation constants (K) as follows:

$$K = (Leq(site\ 2) - Leq(site\ 4))/Log\ (2/1)$$

where the Log (2/1) factor represents the doubling of distance dependency (Site 2 is 492 feet and site 4H is 984 feet from the hover point).

For each mode of operation, the average (over various directivity angles) propagation constant has also been computed.

The data used in this analysis (derived from Appendix C) are displayed in Table 9.6 and the results are summarized in Table 9.7.

At first glance the results may appear somewhat distressing and inconsistent. However, upon consideration of the change in spectral content between different operational scenarios, one may approach a degree of understanding. The following paragraphs attempt to interpret the trends we observe.

Discussion -

HIGE - In the case of HIGE, one must consider the aggregate influence of spreading loss, along with the lumped effects of "ground-to-ground attenuation." The potential exists for refraction effects as well, which might result in shadowing or focusing of sound. The observed rate of attenuation (somewhat unusual) which reflects a grouping of these effects, resulting in a net value of approximately 20.

HOGE - In the case of HOGE, several changes take place. First, the helicopter is at an altitude of approximately 70 feet above ground level, resulting in less tendency for excess ground attenuation. Secondly, the frequency spectra shift toward a greater dominance of middle frequency components. A very reasonable rate of attenuation (propagation constant K=24) is observed, likely dominated by the effects of spherical spreading and absorption.

Flight Idle - In the case of the flight idle operation, one observes a rate of attenuation also in the range one might expect for dominant spherical spreading and atmospheric absorption influences, K=26.

The mercurial nature of ground-to-ground propagation of helicopter noise is very evident from examination of the results presented and discussed above. The primary information value of these results can perhaps be summarized as follows:

1. The rate of diminution in sound will vary with operational mode.
2. Although strong temperature inversion was not present at the time of static operations, experience gained in the Bell 222 test (ref. 8) leads to the following useful observations. The

influence of temperature inversions, typically encountered early on summer mornings, is significant on surface propagation of sound (giving rise to strong refraction effects). This in turn leads to the following axiom: avoid early morning noise assessment/flight testing of helicopters in the static operational modes.

3. While the issue of selecting a representative ground-to-ground attenuation value to use in conducting environmental noise impact analyses remains unresolved, considerable research in this area continues. In the interim, a K value on the order of 25 (i.e., $\Delta dB = 25 \log (d_1/d_2)$) will provide a working approximation for calculating ground-to-ground diminution of A-weighted sound level over nominally soft paths out to distances of 1000 feet.

TABLE 9.6

DATA UTILIZED IN COMPUTING EMPIRICAL
PROPAGATION CONSTANTS (K)

DAUPHIN

6-6-83

SITE 4A--HOVER DATA

HIGE		HOGE		FLT. IDLE	
I-0	60.1	K-0	70.1	J-0	65
I-315	66.1	K-315	71.8	J-315	71.2
I-270	78.1	K-270	73.9	J-270	69.3
I-225	72.9	K-225	75.3	J-225	66
I-180	79.4	K-180	75.3	J-180	58.2
I-135	66.3	K-135	73.2	J-135	57.7
I-90	71.9	K-90	71.3	J-90	62.9
I-45	71.2	K-45	74.2	J-45	61.6

DAUPHIN

6-6-83

SITE 2--HOVER DATA

HIGE		HOGE		FLT. IDLE	
I-0	74.9	K-0	77.7	J-0	69.9
I-315	74.6	K-315	80.1	J-315	78.1
I-180	82	K-270	80.6	J-270	78
I-135	75.1	K-225	82.8	J-225	73.4
I-90	74.8	K-180	82.7	J-180	65
I-45	76.2	K-135	79.1	J-135	67
		K-90	80	J-90	78.4
		K-45	80.8		

TABLE 9.7

EMPIRICAL PROPAGATION CONSTANTS (K)

EMISSION ANGLE	HIGE K	HOGE K	FLT ID K
0	22.59	25.25	22.92
315	21.59	27.57	22.92
270		22.26	28.9
225		24.92	24.58
180	8.64	24.92	22.59
135	29.24	19.6	37.54
90	16.28	28.9	24.92
45	16.61	21.93	
-----	-----	-----	-----
AVERAGE	19.16	2[illegible].42	26.34
	21.26*	25.11**	24.47***

*AVERAGE CALCULATED WITHOUT 180 DEGREE DATA(8.64)

**AVERAGE CALCULATED WITHOUT 135 DEGREE DATA (19.6)

***AVERAGE CALCULATED WITHOUT 135 DEGREE DATA (37.54)

9.8 Acoustical Propagation Analysis - The approach and takeoff operations provided the opportunity to assess emp' 'ically the influences of spherical spreading and atmospheric absorption. Through utilization of both noise and position data at each of the three flight track centerline locations (microphones 5, 1, and 4), it was possible to determine air-to-ground propagation constants.

The propagation constants (one would expect) would reflect the aggregate influences of spherical spreading and atmospheric absorption. It is assumed that the acoustical source characteristics remain constant as the helicopter passes over the measurement array. In the case of a 60-knot approach or takeoff, a helicopter would require approximately 10 seconds to travel the distance between measurements sites 4 and 5.

In both the case of the single event intensity metric, AL, and the single event energy metric, SEL, the difference between SEL and AL is determined for each pair of centerline sites. The delta in each case is then equated with the base ten logarithm of the respective altitude ratio multiplied by the propagation constant (either KP(AL) or KP(SEL), the values to be determined.

Data have also been analyzed from the 500 and 1000 foot level flyover operations and the KP(AL) has been computed. Data were pooled for all centerline sites (5, 1, and 4) in the process of arriving at the propagation constant.

The takeoff analyses are shown in Table 9.8, 9.9, and 9.10 and are summarized in Table 9.14. The approach analyses are shown in Tables 9.11 and 9.12 and are summarized in Table 9.13. Results of the level flyover calculations are presented in Table 9.15. In addition, level flyover data reported for the Bell 222 helicopter (ref. 8) have been further analyzed and are presented in Table 9.16. Level flyover data are summarized in Table 9.17.

TABLE 9.8

HELICOPTER: DAUPHIN

TEST DATE: 6-6-83

OPERATION: ICAO TAKEOFF

MIC. 5-4

EVENT NO.	KP(AL)	KP(SEL)
E26	NA	NA
E27	20.4	13.3
E28	23.2	15.3
E29	20.8	18.3
E30	20.3	15.9
E31	23.7	15.4
E32	23.9	17.2
E33	15.2	15.6
AVERAGE	21.1	15.9
STD. DEV	3.03	1.59
90% C.I.	2.23	1.16

TABLE 9.9

HELICOPTER: DAUPHIN

TEST DATE: 6-6-83

OPERATION: DIRECT CLIMB TAKEOFF (BEST RATE OF CLIMB)

MIC. 5-4

EVENT NO.	KP(AL)	KP(SEL)
GA37	23.1	17
GA38	17.3	14.1
GA39	20.4	14.4
AVERAGE	20.3	15.2
STD. DEV	2.90	1.58
90% C.I.	4.89	2.66

TABLE 9.10

HELICOPTER: DAUPHIN

TEST DATE: 6-6-83

OPERATION: DIRECT CLIMB TAKEOFF (BEST RATE OF CLIMB)

MIC. 5-4

EVENT NO.	KP(AL)	KP(SEL)
GB41	32.3	23.6
GB42	18.1	13
GB43	18.6	13
GB44	17.5	15.4
GB45	16.2	12.9
AVERAGE	20.5	15.6
STD. DEV	6.65	4.60
90% C.I.	6.34	4.39

TABLE 9.11

HELICOPTER: DAUPHIN

TEST DATE: 6-6-83

OPERATION: 6 DEGREE APPROACH (ICAO)

MIC. 5-4

EVENT NO.	KP(AL)	KP(SEL)
F36	27.8	16
F46	35.9	25.6
F47	48.5	25.7
F48	25.8	14.7
F49	23.4	17.9
F50	33.9	20
AVERAGE	32.5	20
STD. DEV	9.16	4.73
90% C.I.	7.54	3.89

TABLE 9.12

HELICOPTER: DAUPHIN

TEST DATE: 6-6-83

OPERATION: 9 DEGREE APPROACH

MIC. 5-4

EVENT NO.	KP(AL)	KP(SEL)
H53	42.4	28.7
H54	38.4	24.3
H55	42.3	22.9
H56	33.4	19.3
AVERAGE	39.1	23.8
STD. DEV	4.26	3.87
90% C.I.	5.01	4.55

TABLE 9.13

Summary Table of Propagation Constants for Two Approach Operations

6 Degree (ICAO) Approach	32.5
9 Degree Approach	39.1
Average	35.80

TABLE 9.14

Summary Table of Propagation Constants for Three Takeoff Operations

ICAO Takeoff	21.2
Direct Climb Takeoff (Best rate of climb)	20.3
Direct Climb Takeoff (Best angle of climb)	20.5
Average	20.67

TABLE 9.15

LEVEL FLYOVER PROPAGATION ANALYSIS

Operation	Microphone Site 5	Microphone Site 1	Microphone Site 4	Weighted Average
500' .9 V_H	N = 8 $\overline{AL}$ = 78.8 σ = 1.5	N = 8 $\overline{AL}$ = 78.5 σ = 1.6	N = 8 $\overline{AL}$ = 77.8 σ = 1.4	78.38
1000' .9 V_H	N = 5 $\overline{AL}$ = 71.8 σ = 0.8	N = 5 $\overline{AL}$ = 71.8 J = 1.0	N = 5 $\overline{AL}$ = 71.1 σ = 1.2	71.57

ΔdB = 6.8

K = dB/log(1000/500)
K = 6.8/0.3
K = 22.67

TABLE 9.16

VARIATION IN LEVEL FLYOVER NOISE
LEVELS - Bell 222*

Operation	Average L_{AM} for Three Microphone Sites (6 events)
500' at .9 V	79.8
1000' at .9 Vne	71.5

$$\Delta dB = 8.35$$
$$K(P) = 8.35/(\log 1000/500) = 27.8$$

* Reference 8

TABLE 9.17

Summary for Level Flyover Operations

Helicopter	Propagation Constant (k)
Bell 222	27.8
Aerospatiale Dauphin 2	22.7
Average	25.25

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3. "Noise Standards: Aircraft Type and Airworthiness Certification," Federal Aviation Regulations Part 36, Department of Transportation, Washington, D.C., June 1974.

4. FAR 36, Appendix B, Section B36.2.3.3.

5. "International Standards and Recommended Practices - Aircraft Noise," Annex 16, International Civil Aviation Organization, May 1981, Appendix 4, paragraph 4.3.

6. Westland Helicopters Limited, via P. R. Kearsey, personal communication, January 1984.

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APPENDIX A

Magnetic Recording Acoustical Data and Duration Factors for Flight Operations

This appendix contains magnetic recording acoustical data acquired during flight operations. A detailed discussion is provided in section which describes the data reduction and processing procedures. Helpful cross references include measurement location layout, Figure 3.3; measurement equipment schematic, Figure 5.4; and measurement deployment plan, Figure 5.7. Tables A.a and A.b which follow below provide the reader with a guide to the structure of the appendix and the definition of terms used herein.

TABLE A.a

The key to the table numbering system is as follows:

```
Table No.    A.                          1-1.          1
             |                            |            |
Appendix No._|                            |            |
Helicopter No. & Microphone Location______|            |
Page No. of Group______________________________________|
```

Microphone No.	1	centerline-center
	1G	centerline-center(flush)
	2	sideline 492 feet (150m) south
	3	sideline 492 feet (150m) north
	4	centerline 492 feet (150m) west
	5	centerline 617 feet (188m) east

TABLE I.1

SURFACE METEOROLOGICAL DATA

TEST DATE: June 6, 1983 **HELICOPTER:** SA-365 Dauphin **LOCATION: DULLES, SITE #4***

TIME (EDT)	TEMPERATURE °F(°C)	HUMIDITY (%)	WINDSPEED AVG (MPH)	WINDSPEED RANGE (MPH)	WIND DIRECTION (DEGREES)	REMARKS
05:30	59(15)	95	3	0-6	180	
05:45	60(15)	98	3	0-6	150	
06:00	60(15)	100	2	0-4	30	
06:15	60(15)	100	1	0-2	140	
06:30	61(16)	100	1	0-2	180	
06:45	61(16)	99	3	0-6	50	
07:00	62(17)	98	3	0-6	130	
07:15	63(17)	94	3	1-6	110	Hazy sky, wet ground
07:30	64(18)	90	5	2-10	160	
07:45	65(18)	86	10	9-20	170	
08:00	66(19)	82	11	7-15	180	
8:15	66(19)	80	12	7-16	180	
08:30	67(19)	78	11	6-16	190	
08:45	68(20)	73	9	6-14	190	
09:00	69(20)	70	8	3-13	210	
09:15	70(21)	63	6	3-10	200	
09:30	71(22)	60	7	2-11	180	
09:45	72(22)	61	6	2-10	150	Sunny and Hazy, dry ground
10:00	72(22)	60	6	4-10	140	
10:15	73(23)	58	8	5-9	170	
10:30	73(23)	58	11	7-16	160	
10:45	74(23)	58	14	9-20	160	
11:00	75(24)	57	12	7-15	170	
11:15	74(23)	57	14	8-20	190	

SENSOR HEIGHT IS 9 FEET ABOVE GROUND

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APPENDIX I

On-Site Meteorological Data

This appendix presents a summary of meteorological data collected on-site by TSC personnel using a climatronics model EWS weather system. The anemometer and temperature sensor were located 5 feet above ground level at noise site 4. The data collection is further described in Section 5.5.

Within each table, the following data are provided:

Time(EDT)	expressed in Eastern Daylight Time
Temperature	expressed in degrees Fahrenheit and centigrade
Humidity	expressed as a percent
Windspeed	expressed in knots
Wind Direction	direction from which the wind is blowing
Remarks	observations concerning cloud cover and visibility

TABLE H.1.2

SURFACE METEOROLOGICAL DATA (NWS)

TEST DATE: June 6, 1983 HELICOPTER: SA-365 Dauphin (CONT) LOCATION: DULLES AIRPORT*

TIME (EDT)	BAROMETRIC PRESSURE (INCHES)	TEMPERATURE °F(°C)	HUMIDITY (%)	WIND SPEED (MPH)	WIND DIRECTION (DEGREES)
10:17	29.83	76(24)	82	7	140
10:30	29.83	76(24)	82	7	160
10:43	29.83	77(25)	79	8	140
10:52	29.83	78(25)	77	6	160
11:14	29.82	78(25)	77	7	190
11:35	29.82	78(25)	77	7	170
11:52	29.81	79(26)	74	9	170
12:12	29.81	80(27)	72	9	170
12:34	29.79	80(27)	72	10	150
12:55	29.79	81(27)	69	11	180

*Sensors located approximately 2 miles east of measurement array

TABLE H.1.1

SURFACE METEOROLOGICAL DATA (NWS)

TEST DATE: June 6, 1983 HELICOPTER: SA-365 Dauphin LOCATION: DULLES AIRPORT*

TIME (EDT)	BAROMETRIC PRESSURE (INCHES)	TEMPERATURE °F(°C)	HUMIDITY (%)	WIND SPEED (MPH)	WIND DIRECTION (DEGREES)
05:31	29.86	58(14)	96	3	120
05:44	29.85	56(13)	100	3	100
05:51	29.86	56(13)	100	3	110
06:15	29.86	58(14)	93	2	160
06:29	29.87	57(14)	96	3	150
06:46	29.87	59(15)	93	3	150
06:52	29.86	60(15)	93	3	150
07:14	29.87	62(17)	93	2	160
07:30	29.87	64(18)	90	5	150
07:45	29.87	65(18)	96	5	160
07:52	29.87	66(19)	93	6	160
08:16	29.87	67(19)	93	7	170
08:29	29.87	69(20)	90	7	180
08:44	29.86	69(20)	93	6	190
08:52	29.86	69(20)	97	5	160
09:17	29.85	71(22)	93	3	190
09:31	29.84	73(23)	87	4	160
09:47	29.83	74(23)	35	4	160
09:54	29.83	75(24)	85	6	130

*Sensors located approximately 2 miles east of measurement array

DATE: 6 / 6 / 83

TIME: 900 EST FLIGHT # 7 EDT 1000

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1000.0	23.9	72	105	5
100	996.5	23.1	74	-999	-999
200	993.1	22.4	76	218	5
300	989.6	21.8	77	201	3
400	986.1	21.4	77	180	4
500	982.7	21.2	79	189	5
600	979.3	21.0	81	164	4
700	975.8	20.8	82	178	4
800	972.5	20.7	82	193	6
900	969.1	20.6	82	207	8
1000	965.7	20.6	82	207	10
1100	962.3	20.5	82	202	11
1200	958.9	20.4	82	199	12
1300	955.5	20.4	82	198	13
1400	952.1	20.3	82	194	13
1500	948.8	20.2	82	186	15
1600	945.4	20.1	80	181	15
1700	942.1	20.1	78	180	16
1800	938.7	19.9	77	182	17
1900	935.5	19.7	77	185	18
2000	932.2	19.5	77	186	20
2100	928.9	19.3	77	185	20
2200	925.6	19.1	77	183	19
2300	922.3	18.9	76	179	18
2400	919.1	18.7	76	178	17
2500	915.8	18.5	75	177	17
2600	912.6	18.2	75	176	18
2700	909.3	18.0	74	178	18
2800	906.1	17.7	75	180	20
2900	903.0	17.5	77	180	18
3000	899.8	17.2	78	181	19

APPENDIX H

NWS - IAD Surface Meteorological Data

This appendix presents a summary of meteorological data gleaned from measurements conducted by the National Weather Service Station at Dulles. Readings were noted evey 15 minutes during the test. The data acquisition is described in Section 5.5.

Within each table the following data are provided:

Time(EDT)	time the measurement was taken, expressed in Eastern Daylight Time
Barometric pressure	expressed in inches of mercury
Temperature	expressed in degrees Fahrenheit and centigrade
Humidity	relative, expressed as a percent
Wind Speed	expressed in knots
Wind Direction	direction from which the wind is moving

DATE: 6 / 6 / 83

TIME: 759 EST FLIGHT # 6 EDT 859

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1001.2	21.7	79	160	3
100	997.7	20.6	80	-999	-999
200	994.2	19.7	82	-999	-999
300	990.7	19.5	85	226	5
400	987.2	19.4	88	227	5
500	983.7	19.2	89	208	3
600	980.3	19.0	89	215	5
700	976.8	19.1	87	216	9
800	973.3	19.6	83	219	12
900	969.9	20.0	83	223	13
1000	966.5	20.4	83	222	13
1100	963.1	20.5	83	216	13
1200	959.7	20.5	82	215	14
1300	956.3	20.5	82	210	14
1400	953.0	20.2	83	207	16
1500	949.6	19.9	84	202	15
1600	946.3	19.6	85	201	18
1700	943.0	19.3	83	199	21
1800	939.7	19.2	82	196	19
1900	936.3	19.2	82	197	18
2000	933.0	19.1	81	196	18
2100	929.7	18.9	81	198	21
2200	926.5	18.6	81	197	19
2300	923.2	18.3	81	198	19
2400	919.9	18.1	81	195	17
2500	916.7	17.9	80	195	16
2600	913.4	17.8	79	193	17
2700	910.2	17.6	79	194	17
2800	906.9	17.4	78	196	17
2900	903.7	17.2	77	197	18
3000	900.5	16.8	74	197	16

DATE: 6 / 6 / 83

TIME: 659 EST FLIGHT # 5 EDT 759

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1001.3	19.3	90	180	3
100	997.7	16.6	87	-999	-999
200	994.2	12.5	91	-999	-999
300	990.7	12.6	94	156	9
400	987.2	17.7	95	181	16
500	983.7	17.5	96	180	18
600	980.2	17.4	96	177	18
700	976.7	17.4	97	175	14
800	973.3	18.4	91	192	8
900	969.9	19.4	86	219	11
1000	966.5	20.5	81	228	15
1100	963.1	20.9	78	223	20
1200	959.7	20.8	76	215	19
1300	956.3	20.7	75	213	18
1400	953.0	20.4	74	208	20
1500	949.6	20.2	74	205	21
1600	946.3	20.0	73	200	21
1700	942.9	19.8	74	198	18
1800	939.6	19.6	75	199	18
1900	936.3	19.4	75	199	19
2000	933.0	19.2	76	199	19
2100	929.7	19.0	77	196	18
2200	926.4	18.8	78	199	20
2300	923.1	18.6	79	198	22
2400	919.9	18.4	79	197	22
2500	916.6	18.1	80	197	21
2600	913.4	17.9	81	196	20
2700	910.1	17.7	82	199	22
2800	906.9	17.4	83	199	22
2900	903.6	17.1	82	197	21
3000	900.4	16.7	79	197	22

DATE: 6 / 6 / 83

TIME: 603 EST FLIGHT # 4 EDT 703

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1001.2	15.6	95	180	3
100	997.6	16.7	95	-999	-999
200	994.1	17.7	96	-999	-999
300	990.6	18.1	96	231	10
400	987.1	18.6	97	229	13
500	983.6	19.2	95	238	20
600	980.1	20.1	89	236	22
700	976.7	20.9	84	230	21
800	973.2	21.4	80	224	22
900	969.9	21.4	78	219	22
1000	966.5	21.5	76	205	18
1100	963.1	21.4	74	195	17
1200	959.7	21.3	72	199	19
1300	956.3	21.1	71	206	21
1400	953.0	20.8	71	201	21
1500	949.7	20.5	72	205	22
1600	946.4	20.2	72	209	20
1700	943.0	19.9	72	200	19
1800	939.7	19.5	72	203	18
1900	936.4	19.2	73	209	19
2000	933.0	18.9	73	209	17
2100	929.8	18.7	74	203	15
2200	926.5	18.5	75	201	16
2300	923.2	18.3	77	201	18
2400	919.9	18.1	77	204	18
2500	916.7	18.0	77	210	18
2600	913.4	17.9	78	202	19
2700	910.2	17.8	78	197	20
2800	906.9	17.6	78	203	19
2900	903.7	17.3	78	199	17
3000	900.5	17.0	78	195	19

DATE: 6 / 6 / 83

TIME: 530 EST FLIGHT # 3 EDT 630

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1001.1	14.5	94	0	0
100	997.5	16.2	91	-999	-999
200	994.0	16.6	91	-999	-999
300	990.5	17.0	93	199	9
400	987.0	17.4	94	198	11
500	983.5	17.7	95	214	13
600	980.0	18.3	94	222	15
700	976.5	18.8	92	225	17
800	973.1	19.4	89	225	20
900	969.6	20.0	85	221	19
1000	966.2	20.4	81	213	19
1100	962.9	20.6	78	209	21
1200	959.5	20.7	76	208	21
1300	956.1	20.8	74	208	22
1400	952.7	20.8	72	203	18
1500	949.4	20.5	72	204	19
1600	946.0	20.2	72	206	20
1700	942.7	19.9	72	204	20
1800	939.4	19.6	73	204	19
1900	936.1	19.3	73	205	19
2000	932.8	19.1	74	205	18
2100	929.5	18.8	74	206	19
2200	926.2	18.5	75	207	19
2300	922.9	18.2	75	205	20
2400	919.6	17.9	76	205	19
2500	916.3	17.8	76	204	17
2600	913.1	17.6	76	204	18
2700	909.9	17.5	77	205	20
2800	906.6	17.3	77	202	18
2900	903.4	17.2	77	206	17
3000	900.2	16.9	76	205	18

DATE: 6 / 6 / 83

TIME: 500 EST FLIGHT # 2 EDT 600

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1000.9	14.6	94	0	0
100	997.4	16.3	97	-999	-999
200	993.9	16.5	97	-999	-999
300	990.3	16.7	97	-999	-999
400	986.8	16.9	96	199	12
500	983.2	17.1	96	201	14
600	979.7	17.4	96	207	15
700	976.3	17.8	94	211	15
800	972.8	18.2	93	216	17
900	969.4	18.7	91	219	18
1000	966.0	19.1	89	215	23
1100	962.5	19.6	86	207	24
1200	959.1	20.1	75	202	23
1300	955.8	20.1	74	209	24
1400	952.4	20.1	74	202	21
1500	949.1	20.1	73	201	19
1600	945.7	19.9	73	201	18
1700	942.4	19.7	74	203	18
1800	939.0	19.5	74	201	19
1900	935.7	19.4	72	200	17
2000	932.4	19.2	70	204	17
2100	929.1	19.1	68	206	15
2200	925.9	18.9	68	206	16
2300	922.6	18.8	68	206	18
2400	919.4	18.6	68	205	17
2500	916.1	18.5	68	203	15
2600	912.9	18.3	68	204	13
2700	909.6	18.1	68	205	16
2800	906.4	18.0	68	206	16
2900	903.1	17.8	68	206	15
3000	899.9	17.5	69	207	14

DATE: 6 / 6 / 83

TIME: 431 EST FLIGHT # 1 EDT 531

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1000.8	14.6	95	0	0
100	997.3	16.8	96	-999	-999
200	993.7	17.1	95	-999	-999
300	990.2	17.5	94	220	10
400	986.6	17.8	94	220	12
500	983.2	18.1	94	220	14
600	979.7	18.3	95	219	16
700	976.3	18.6	95	220	19
800	972.8	18.8	95	217	17
900	969.4	19.6	89	210	19
1000	966.0	20.3	84	206	19
1100	962.5	21.1	78	203	18
1200	959.1	21.3	75	203	21
1300	955.8	21.1	72	204	20
1400	952.4	20.8	70	207	21
1500	949.1	20.6	69	207	22
1600	945.8	20.3	68	208	19
1700	942.4	20.0	66	211	15
1800	939.1	19.9	66	205	15
1900	935.8	19.9	66	205	15
2000	932.5	19.8	66	207	14
2100	929.2	19.6	66	205	15
2200	926.0	19.3	66	204	14
2300	922.8	19.0	67	205	16
2400	919.5	18.7	67	204	15
2500	916.3	18.5	67	205	15
2600	913.0	18.2	67	210	16
2700	909.8	17.9	68	209	15
2800	906.6	17.6	68	210	14
2900	903.3	17.4	68	212	16
3000	900.1	17.1	68	211	18

APPENDIX G

NWS Upper Air Meteorological Data

This appendix presents a summary of meteorological data gleaned from National Weather Service radiosonde (rawinsonde) weather balloon ascensions conducted at Sterling, VA. The data collection is further described in Section 5.4. Tables are identified by launch date and launch time. Within each table the following data are provided:

Time	expressed first in eastern standard, then in Eastern Daylight Time
Surface Height	height of launch point with respect to sea level
Height	height above ground level, expressed in feet
Pressure	expressed in millibars
Temperature	expressed in degrees centigrade
Relative Humidity	expressed as a percent
Wind Direction	measured in the direction from which the wind is blowing
Wind Speed	expressed in knots

HELICOPTER: DAUPHIN

TABLE F.7

TEST DATE: 6-6-83

OPERATION: DIRECT CLIMB TAKEOFF (BEST RATE OF CLIMB)

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
6A37	117.9	108.8	171.5	163.6	214.2	205.1	521	19.2	518.8	19.6	6.40	4.80	5.59	5
6A38	122.7	113.8	175.2	167.5	217.2	208.2	522.3	19.6	520.1	20	6.20	4.70	5.48	4.9
6A39	106.5	99.3	152.7	144.7	189.6	182.4	515.2	17.2	513.4	17.6	5.30	4.40	4.83	4.3
6A40	114.2	111.2	169.1	146.9	212.9	211.4	520.3	19	518	19.4	4.20	7.50	5.81	5.1
6A41	177.2	157.4	299.4	NA	372.1	352.3	575.9	31.3	568	NA	NA	NA	11.20	11.2

HELICOPTER: DAUPHIN

TABLE F.8

TEST DATE: 6-6-83

OPERATION: DIRECT CLIMB TAKEOFF (BEST ANGLE OF CLIMB)

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
6B41	232.5	NA	305.8	293.9	364.2	352.3	579.3	31.9	582.2	NA	NA	6.80	NA	6.8
6B42	181.7	165.5	279.1	264.2	356.9	340.6	565.7	29.6	559.6	30.2	11.30	8.80	10.09	9.1
6B43	199.5	174.6	313.7	309.7	404.7	378.1	583.5	32.5	575.8	33.2	15.40	7.90	11.68	10.6
6B44	213.7	192	327.8	316.5	418.8	396.3	591.2	33.7	583.2	34.4	14.20	9.20	11.73	10.6
6B45	221.9	195.9	349.6	323.6	477.3	NA	603.5	35.4	610.5	NA	14.60	NA	NA	14.6

HELICOPTER: DAUPHIN

TABLE F.9

TEST DATE: 6-6-83

OPERATION: 9 DEGREE APPROACH

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
H53	268.5	251.3	383.3	361.6	474.9	458	623.7	37.9	614.8	38.5	12.60	11.10	11.86	10.7
H54	281.8	260.9	389.1	379.5	474.6	452.9	627.2	38.3	618.8	38.9	13.60	8.50	11.04	10
H55	317.1	305.3	401.7	393.6	469.3	458	635.2	39.2	628.4	39.7	9.00	8.60	8.82	7.9
H56	278.5	260.9	385.4	368.8	470.6	452.9	625	38.1	616.6	38.6	12.40	9.70	11.04	9.9

HELICOPTER: DAUPHIN

TABLE F.5

TEST DATE: 6-6-83

OPERATION: ICAO TAKEOFF

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
E26	228.4	213.6	301.1	286.3	373.8	NA	576.8	31.5	580.4	NA	8.40	NA	NA	8.4
E27	255.6	235.5	352.3	346.6	429.3	408.1	605.1	35.6	598	36.2	12.70	7.10	9.95	9
E28	267.1	NA	348.5	335.3	413.4	400.2	602.9	35.3	606.4	NA	NA	7.50	NA	7.5
E29	256.6	238.2	341.1	338.1	408.4	388.8	598.7	34.7	592.6	35.2	11.50	5.90	8.70	7.8
E30	244	224	326.9	328.4	393	371.3	590.7	33.6	594.9	34.1	12.00	5.00	8.51	7.7
E31	248.4	226.5	343.8	342.9	419.9	396.3	600.2	34.9	593.3	35.5	13.30	6.20	9.79	8.9
E32	233.8	215.8	322.7	316.5	393.7	374.7	588.4	33.3	582.2	33.8	11.60	6.70	9.17	8.3
E33	226.7	211.4	308.6	300	374.2	358.4	580.9	32.1	575.1	32.6	10.20	6.80	8.50	7.6

HELICOPTER: DAUPHIN

TABLE F.6

TEST DATE: 6-6-83

OPERATION: 6 DEGREE ICAO APPROACH

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
F36	322.6	312.3	386.3	NA	424.1	413.8	625.5	38.1	620.5	NA	NA	NA	5.89	5.9
F46	296	288	356.9	342.9	405.4	397.8	607.8	36	603.3	36.3	6.40	6.40	6.37	5.6
F47	298.8	292.3	344.4	334.9	380.7	374.5	600.5	35	597.2	35.3	4.90	4.60	4.78	4.2
F48	296.3	284.3	356.8	352	405.1	392.5	607.8	36	603.3	36.3	7.80	4.70	6.28	5.6
F49	304.6	292.3	362.9	360	409.4	396.3	611.4	36.4	607	36.7	7.80	4.20	6.03	5.4
F50	293.9	280.4	369.6	360	430.1	416.3	615.4	36.9	609.6	37.3	9.20	6.50	7.86	7
F51	298	290.3	339.5	334.9	372.7	364.8	597.8	34.6	594.8	34.9	5.20	3.50	4.33	3.9

HELICOPTER: DAUPHIN

TABLE F.3

TEST DATE: 6-6-83

OPERATION: 500 FT FLYOVER(0.7*VH)/TARGET IAS=105 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
EVENT NO	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. CPA	ELEV ANG	EST. CPA	ELEV ANG	ANG 5-1	ANG 1-4	ANG 5-4	C/D ANGLE
C15	509.1	510.1	503.3	NA	499.7	500.7	703.8	45.6	704.3	NA	NA	NA	-0.55	-.4
C16	481.8	481.6	476	479.6	471.4	470.9	684.6	44.1	685.1	44	-0.10	-0.90	-0.62	-.4
C17	495.3	496.3	439.2	NA	485.5	486.5	693.8	44.3	694.3	NA	NA	NA	-0.57	-.5
C18	493.2	491.3	498.6	500.1	502.9	500.7	700.5	45.4	700	45.4	1.00	0.10	0.55	.5
C19	466.6	467.8	459.3	NA	455	456.2	673.1	43	673.7	NA	NA	NA	-0.68	-.6
C20	476.1	477	475	473.6	474.1	475.2	683.9	44	684	44	-0.30	0.20	-0.10	0

HELICOPTER: DAUPHIN

TABLE F.4

TEST DATE: 6-6-83

OPERATION: 1000 FT FLYOVER(0.9*VH)/TARGET IAS=135 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
EVENT NO	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. CPA	ELEV ANG	EST. CPA	ELEV ANG	ANG 5-1	ANG 1-4	ANG 5-4	C/D ANGLE
D21	944.3	945.5	936.5	NA	932	933.2	1057.9	62.3	1058.8	NA	NA	NA	-0.72	-.6
D22	1032.1	1020	1041.7	1064	1049.3	1034.5	1152	64.7	1150.9	64.7	5.10	-3.30	0.84	.9
D23	999.2	999.9	994.6	NA	991.9	992.6	1109.6	63.7	1110.1	NA	NA	NA	-0.43	-.3
D24	977.2	970.4	974	973	971.5	972.9	1091.2	63.2	1091.6	63.2	-0.50	0.00	-0.32	-.2

HELICOPTER: DAUPHIN

TABLE F.1

TEST DATE: 6-6-83

OPERATION: 500 FT FLYOVER(0.9*VH)/TARGET IAS=135 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
EVENT NO	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. CPA	ELEV ANG	EST. CPA	ELEV ANG	ANG 5-1	ANG 1-4	ANG 5-4	C/D ANGLE
A1	NA	462.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
A2	NA	442.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
A3	NA	416.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
A4	398.7	393.8	423	418.1	447.3	NA	648.9	40.7	650.3	NA	2.80	NA	NA	2.8
A5	486.2	486.4	484.8	NA	484	484.2	690.7	44.6	690.8	NA	NA	NA	-0.13	0
A6	503.8	503.1	506.6	506.6	508.9	508.2	706.2	45.8	705.9	45.9	0.40	0.20	0.30	.3
A7	478.6	478.5	479.4	NA	479.8	479.7	686.9	41.3	686.9	NA	NA	NA	0.07	.1
A8	491.2	491.3	496.3	493.5	500.4	500.7	698.9	45.3	698.4	45.3	0.30	0.80	0.55	.5
A9	486.2	486.4	484.8	NA	484	484.2	690.7	44.6	690.8	NA	NA	NA	-0.13	0
A10	507.3	504.8	505.4	512.1	503.9	500.7	705.4	45.8	705.5	45.8	0.90	-1.20	-0.24	-.1

HELICOPTER: DAUPHIN

TABLE F.2

TEST DATE: 6-6-83

OPERATION: 500 FT FLYOVER(0.8*VH)/TARGET IAS=120 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
EVENT NO	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. CPA	ELEV ANG	EST. CPA	ELEV ANG	ANG 5-1	ANG 1-4	ANG 5-4	C/D ANGLE
B11	475.9	474.2	486.6	NA	492.9	491.2	692	44.7	691	NA	NA	NA	0.99	1
B12	460	462	459.9	455.4	459.9	462.4	673.5	43.1	673.5	43.1	-0.70	0.80	0.02	0
B13	492.1	493	486.6	NA	483.3	484.2	692	44.7	692.5	NA	NA	NA	-0.51	-.4
B14	443.1	439.8	445.1	451.6	446.6	442.5	663.4	42.1	663.3	42.1	1.40	-1.00	0.16	.2

APPENDIX F

Photo-Altitude and Flight Path Trajectory Data

This appendix contains the results of the photo-altitude and flight path trajectory analysis.

The helicopter altitude over a given microphone was determined by a photographic technique which involves photographing an aircraft during a flyover event and proportionally scaling the resulting image with the known dimensions of the aircraft. The data acquisition is described in detail in Section 5.2. The detailed data reduction procedures is set out in Section 6.2.1; the analysis of these data is discussed in Section 8.2

Each table within this appendix provides the following information:

Event No.	the test run number
Est. Alt.	estimated altitude above microphone site
P-Alt.	altitude above photo site, determined by photographic technique
Est. CPA	estimated closest point of approach to microphone site
Est. ANG	Helicopter elevation with respect to the ground as viewed from a sideline site as the helicopter passes through a plane perpendicular to the flight track and coincident with the observer location.
ANG 5-1	flight path slope, expressed in degrees, between P-Alt site 5 and P-Alt site 1.
ANG 1-4	flight path slope, expressed in degrees, between P-Alt Site 1 and P-Alt Site 4.
ANG 5-4	flight path slope, expressed in degrees, between P-Alt Site 5 and P-Alt Site 4.
Reg C/D Angle	flight path slope, expressed in degress, of regression line through P-Alt data points.

TABLE E.2.3

COCKPIT OBSERVOR LOG

HELICOPTER: DAUPHIN SA 365N

TEST DATE: 6-6-83

EVENT NO.	EVENT TYPE	TIME OF OBSERVATION	HEADING	INDICATED AIRSPEED (KTS)	ALTIMETER (AGL) FEET	OUTSIDE AIR TEMPERATURE (C°)	ROTOR SPEED (RPM)	TORQUE (%)	FUEL (Kg)
H53	9 Degree Approach	9:57		75	1000	20°	350	25	430/430
H54	9 Degree Approach	10:01		75	1000	21°	350	25	410/410
H55	9 Degree Approach	10:05		75	1000	21°	350	20	410/410
H56	9 Degree Approach	10:10		75	1000	21°	350	20	410/410
H57	9 Degree Approach	10:13		75	1000	21°	350		400/400
I58	HIGE	10:40		0	300	25°	350	85	350/370
I59	HIGE	10:41		0	300	25°	350	85	350/370
I60	HIGE	10:43		0	300	25°	350	85	350/370
I61	HIGE	10:44		0	300	25°	350	85	350/370
I62	HIGE	10:45		0	300	25°	350	85	350/370
I63	HIGE	10:47		0	300	25°	350	85	350/370
I64	HIGE	10:48		0	300	25°	350	85	350/370
I65	HIGE	10:50		0	300	25°	350	85	350/370
I66	HIGE	10:52		0	300	25°	350	85	350/370
I67	HIGE	10:54		0	300	25°	350	85	320/350
I68	HIGE	10:55		0	300	25°	350	85	320/350
I69	HIGE	10:56		0	300	25°	350	85	320/350
J70	Flight Idle	10:58		0	300	25°	345	25	
J71	Flight Idle	11:00		0	300	25°	345	25	
J72	Flight Idle	11:02		0	300	25°	345	25	
J73	Flight Idle	11:04		0	300	25°	345	25	
J74	Flight Idle	11:15		0	300	25°	340	25	
J75	Flight Idle	11:16		0	300	25°	345	25	
J76	Flight Idle	11:17		0	300	25°	345	25	
J77	Flight Idle	11:19		0	300	25°	345	25	
K78	HOGE	11:20		0	370	25°	350	90	
K79	HOGE	11:22		0	370	25°	345	85	
K80	HOGE	11:24		0	370	25°	345	85	
K81	HOGE	11:26		0	370	25°	345	80	
K82	HOGE	11:28		0	370	25°	345	85	
K83	HOGE	11:30		0	370	25°	345	85	
K84	HOGE	11:31		0	370	25°	348	85	
K85	HOGE	11:32		0	370	25°	348	87	

TABLE E.2.2

COCKPIT OBSERVOR LOG

HELICOPTER: DAUPHIN SA 365N

TEST DATE: 6-6-83

EVENT NO.	EVENT TYPE	TIME OF OBSERVATION	HEADING	INDICATED AIRSPEED (KTS)	ALTIMETER (AGL) FEET	OUTSIDE AIR TEMPERATURE (C°)	ROTOR SPEED (RPM)	TORQUE (%)	FUEL (Kg)
E26	ICAO TAKEOFF	7:32	W	75	350	16°	350	96	430/430
E27	ICAO TAKEOFF	7:35	W	75	380	16°	350	96	430/430
E28	ICAO TAKEOFF	7:38	W	75	380	16°	350	96	410/420
E29	ICAO TAKEOFF	7:41	W	75	380	16°	350	96	410/420
E30	ICAO TAKEOFF	7:45	W	75	380	16°	350	96	400/410
E31	ICAO TAKEOFF	7:47	W	75	380	16°	350	96	400/410
E32	ICAO TAKEOFF	7:50	W	75	380	17°	350	96	400/410
E33	ICAO TAKEOFF	7:53	W	75	380	17°	350	96	400/400
F34	ICAO APPROACH	8:07	E	78		18°	350		350/350
F35	ICAO APPROACH	8:12	E	75		18°	350		350/350
F36	ICAO APPROACH	8:17	E	75		18°	350		330/340
F47	ICAO APPROACH	8:58	E	75		19°	350		260/280
F48	ICAO APPROACH	9:03	E	75		19°	350		250/260
F49	ICAO APPROACH	9:10	E	75		19°	350		240/250
F50	ICAO APPROACH	9:15	E	75		20°	350		240/240
F51	ICAO APPROACH	9:19	E	75		20°	350		240/240
F52	ICAO APPROACH	9:22	E	75		20°	350		220/230
GA37	TAKEOFF	8:23	W			18°	350		310/320
GA38	TAKEOFF	8:27	W			18°	350		300/300
GA39	TAKEOFF	8:30	W			18°	350		300/300
GA40	TAKEOFF	8:34	W			18°	350		300/300
GB41	TAKEOFF	8:37	W	75		18°	350		290/300
GB42	TAKEOFF	8:40	W	75		18°	350		290/300
GB44	TAKEOFF	8:45	W	75		18°	350		290/300
GB45	TAKEOFF	8:48	W	75		18°	350		280/300
GB46	TAKEOFF	8:51	W	75		18°	350		280/300

TABLE E.2.1

COCKPIT OBSERVOR LOG

HELICOPTER: DAUPHIN SA 365N

TEST DATE: 6-6-83

EVENT NO.	EVENT TYPE	TIME OF OBSERVATION	HEADING	INDICATED AIRSPEED (KTS)	ALTIMETER (AGL) FEET	OUTSIDE AIR TEMPERATURE (C°)	ROTOR SPEED (RPM)	TORQUE (%)	FUEL (Kg)
A1	500' LFO (.9Vh)	5:46	E	135	820	19°	355	94	410/420
A2	500' LFO (.9Vh)	5:43	W	130	820	19°	355	94	410/420
A3	500' LFO (.9Vh)	5:53	E	132	770	19°	355	75	410/420
A4	500' LFO (.9Vh)	5:57	W	120	750	19°	355	94	400/400
A5	500' LFO (.9Vh)	5:58	E	132	850	19°	355	78	400/400
A6	500' LFO (.9Vh)	6:00	W	132	850	19°	355	80	400/400
A7	500' LFO (.9Vh)	6:03	E	132	840	19°	355	80	380/380
A8	500' LFO (.9Vh)	6:05	W	132	830	19°	355	82	380/380
A9	500' LFO (.9Vh)	6:08	E	131	870	19°	355	75	360/360
A10	500' LFO (.9Vh)	6:10	W	130	850	19°	355	80	360/360
B11	500' LFO (.8Vh)	6:15	E	119	880	19°	355	60	340/350
B12	500' LFO (.8Vh)	6:17	W	116	840	19°	355	65	340/350
B13	500' LFO (.8Vh)	6:21	E	116	840	19°	355	62	340/350
B14	500' LFO (.8Vh)	6:23	W	116	850	19°	350	65	320/330
C15	500' LFO (.7Vh)	6:28	E	101	850	19°	350	53	320/330
C16	500' LFO (.7Vh)	6:30	W	100	780	19°	350	55	320/330
C17	500' LFO (.7Vh)	6:35	E	100	850	19°	350	55	320/330
C18	500' LFO (.7Vh)	6:37	W	100	830	19°	350	56	300/310
C19	500' LFO (.7Vh)	6:43	E	100	860	19°	350	54	290/300
C20	500' LFO (.7Vh)	6:46	W	100	820	19°	350	54	290/300
D21	1000' LFO (.9vh)	6:52	E	132	1340	22°	350	74	
D22	1000' LFO (.9Vh)	6:55	W	131	1250	22°	350	80	270/280
D23	1000' LFO (.9Vh)	6:58	E	131	1320	22°	350	79	270/280
D24	1000' LFO (.9Vh)	7:00	W	131	1300	22°	350	78	
D25	1000' LFO (.9Vh)	7:04	E	131	1350	22°	350	78	250/260

TABLE E.1.2

COCKPIT PHOTO DATA

HELICOPTER DAUPHIN TEST DATE 6-6-83

EVENT NO.	EVENT TYPE	TIME OF PHOTO	HEADING (DEGREES)	ALTIMETER (AGL) FT. (METERS)	IAS (KTS)	ROTOR SPEED (RPM OR %)	TORQUE (%)
E30	T/O ICAO	7:45	310	500	73	350	94
E31	T/O ICAO	7:49	310	520	72	350	96
E32	T/O ICAO	7:52	310	520	72	350	95
E33	T/O ICAO	7:55	310	500	75	350	93
E34	T/O ICAO	7:58	310	-	137	350	97
F35	APPROACH	8:09	125	590	75	350	30
F36	APPROACH	8:19	130	490	84	350	35
GA37	T/O	8:25	310	400	72	350	80
GA38	T/O	8:28	310	400	72	350	80
GA39	T/O	8:32	310	400	70	350	80
GA40	T/O	8:35	310	400	70	350	80
GB41	T/O	8:38	310	400	79	350	92
GB42	T/O	8:42	310	400	76	350	92
GB43	T/O	8:46	310	500	76	350	90
GB44	T/O	8:49	310	400	77	350	88
GB45	T/O	8:52	310	490	76	350	94
F46	APPROACH	8:59	125	970	78	350	-
F47	APPROACH	9:05	125	660	74	350	30
F48	APPROACH	9:10	125	-	75	350	30
F49	APPROACH	9:15	125	800	75	350	32
F50	APPROACH	9:20	125	800	72	350	32
F51	APPROACH	9:24	125	680	73	350	32
H52	APPROACH	9:58	125	1020	74	350	12
H53	APPROACH	10:01	125	980	75	350	14
H54	APPROACH	10:05	125	900	79	350	20
H55	APPROACH	10:10	125	875	75	350	22
H56	APPROACH	10:14	130	740	76	350	22

TABLE E.1.1

COCKPIT PHOTO DATA

HELICOPTER DAUPHIN

TEST DATE 6-6-83

EVENT NO.	EVENT TYPE	TIME OF PHOTO	HEADING (DEGREES)	ALTIMETER (AGL) FT. (METERS)	IAS (KTS)	ROTOR SPEED (RPM OR %)	TORQUE (%)
A1	LFO 500'.9VH	5:47	120	800	130	350	-
A2	LFO 500'.9VH	5:49	300	800	130	350	90
A3	LFO 500'.9VH	5:55	120	800	130	350	-
A4	LFO 500'.9VH	5:56	300	800	130	350	90
A5	LFO 500'.9VH	5:59	120	800	130	350	-
A6	LFO 500'.9VH	6:01	300	800	130	350	80
A7	LFO 500'.9VH	6:04	120	840	132	350	78
A8	LFO 500'.9VH	6:06	300	840	132	350	78
A9	LFO 500'.9VH	6:10	120	840	132	350	74
A10	LFO 500'.9VH	6:12	300	860	130	350	78
B11	LFO 500'.8VH	6:15	120	860	118	350	58
B12	LFO 500'.8VH	6:18	310	800	118	350	62
B13	LFO 500'.8VH	6:22	120	800	118	350	60
B14	LFO 500'.8VH	6:24	310	800	105	350	68
C15	LFO 500'.7VH	6:29	120	800	100	350	58
C16	LFO 500'.7VH	6:32	300	800	105	350	58
C17	LFO 500'.7VH	6:36	120	800	100	350	53
C18	LFO 500'.7VH	6:38	310	800	100	350	56
C19	LFO 500'.7VH	6:44	120	800	100	350	52
C20	LFO 500'.7VH	6:47	300	800	100	350	55
D21	LFO 1000'.9VH	6:53	120	1300	130	350	72
D22	LFO 1000'.9VH	6:56	310	1300	130	350	80
D23	LFO 1000'.9VH	6:58	125	1320	130	350	80
D24	LFO 1000'.9VH	7:02	310	1300	130	350	78
D25	LFO 1000'.9VH	7:05	125	1340	130	350	78
E26	T/O ICAO	7:33	310	-	70	350	97
E27	T/O ICAO	7:36	310	-	75	350	95
E28	T/O ICAO	7:39	310	-	75	350	95
E29	T/O ICAO	7:42	310	-	75	350	96

Cockpit Observer Data: Tables E.2.1-E.2.3

In addition to the cockpit photographer, an FAA flight test observer from the FAA Southwest regional office (lead region for rotorcraft certification) recorded data during each event of the Dauphin test. That data is included here as further documentation of the helicopter instrument readings during the tests.

Each table provides the following information:

Event No.	This event number along with the test date provides a cross reference to other data.
Event Type	This specifies the event.
Time of Obserations	The time of the range control synchronized clock consistent with acoustical and tracking time bases.
Heading	The compass magnetic heading which fluctuates around the target heading.
IAS	Indicated airspeed, a fairly stable indicator.
Altimeter	Specifies the barometric altimeter reading, one of the more stable indicators.
Temperature	The outside air temperature, in degrees centigrade.
Rotor Speed	Main rotor speed in RPM or percent, a very stable indicator.
Torque	The torque on the main rotor shaft, a fairly stable value.
Fuel	The amount of fuel in each engine, expressed in kilograms.

APPENDIX E

Cockpit Instrument Photo Data and Observer Data

Cockpit Instrument Photo Data: Tables E.1.1-E.1

During each event of the June 1983 Helicopter Noise Measurement program cockpit photos were taken. The slides were projected onto a screen (considerably enlarged) making it possible to read the instruments with reasonable accuracy. The photos were supposed to be taken when the aircraft was directly over the centerline-center microphone site. Although this was not achieved in each case the cockpit photos reflect the helicopter "stabilized" configuration during the test event. One important caution is necessary in interpreting the photographic information; the snapshot freezes instrument readings at one moment of time whereas most readings are constantly changing by a small amount as the pilot "hunts" for the reference condition. Thus fluctuations above or below reference conditions are to be anticipated. The instrument readings are most useful in terms of verifying the region of operation for different parameters. The data acquisition is discussed in Section 5.3

Each table within this appendix provides the following information:

Event No.	This event number along with the test date provides a cross reference to other data.
Event Type	This specifies the event.
Time of Photo	The time of the range control synchronized clock consistent with acoustical and tracking time bases.
Heading	The compass magnetic heading which fluctuates around the target heading.
Altimeter	Specifies the barometric altimeter reading, one of the more stable indicators.
IAS	Indicated airspeed, a fairly stable indicator.
Rotor Speed	Main Rotor speed in RPM or percent, a very stable indicator.
Torque	The torque on the main rotor shaft, a fairly stable value.

TABLE D.1

STATIC OPERATIONS
DIRECT READ DATA
(ALL VALUES A-WEIGHTED LEQ, EXPRESSED IN DECIBLES)

DAUPHIN

6-6-83

SITE 2 (SOFT SITE)

HIGE		HOGE		FLT. IDLE	
I-0	74.90	K-0	77.70	J-0	69.90
I-315	74.60	K-315	80.10	J-315	78.10
I-270	NA	K-270	80.60	J-270	76.00
I-225	NA	K-225	82.80	J-225	73.40
I-180	82.00	K-180	82.70	J-180	65.00
I-135	75.10	K-135	79.10	J-135	69.00
I-90	76.80	K-90	80.00	J-90	70.40
I-45	76.20	K-45	80.80	J-45	NA

SITE 4 (SOFT SITE)

HIGE		HOGE		FLT. IDLE	
I-0	68.10	K-0	70.10	J-0	63.00
I-315	68.10	K-315	71.80	J-315	71.20
I-270	70.10	K-270	73.90	J-270	69.30
I-225	72.90	K-225	75.30	J-225	66.00
I-180	79.40	K-180	75.20	J-180	58.20
I-135	66.30	K-135	73.20	J-135	57.70
I-90	71.90	K-90	71.30	J-90	62.90
I-45	71.20	K-45	74.20	J-45	61.60

SITE 5H (HARD SITE)

HIGE		HOGE		FLT.IDLE	
I-0	76.30	K-0	82.50	J-0	76.40
I-315	77.80	K-315	88.10	J-315	77.80
I-270	88.90	K-270	85.80	J-270	78.30
I-225	85.20	K-225	87.70	J-225	76.20
I-180	81.90	K-180	86.60	J-180	77.10
I-135	82.50	K-135	85.20	J-135	74.90
I-90	77.40	K-90	76.30	J-90	80.50
I-45	80.50	K-45	82.80	J-45	75.60

APPENDIX D

Direct Read Acoustical Data for Static Operations

This appendix contains time averaged, A-weighted sound level data (Leq values) obtained using direct read Precision Integrating Sound Level meters. Data are presented for microphone locations 5H, 2, and 4 (see Figure 3.3).

A description of the measurement systems is provided in Section 5.6.2, and a figure of the typical PISLM system is shown in Figure 5.4. Data are shown in Table D-1, depicting the equivalent sound levels for eight different source emission angles. In each case the angle is indexed to the specific measurement site. A figure showing the emission angle convention is included in the text (Figure 6.1). In each case, the Leq (or time averaged AL) represents an average over a sample period of approximately 60 seconds.

Quantities appearing in this appendix include:

HIGE	Hover-in-ground-effect, skid height 5 feet above ground level
HOGE	Hover-out-of-ground-effect, skid height 30 feet above ground level
Flight Idle	Skids on ground
Ground Idle	Skids on ground

TABLE NO. C.1-5H.4

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN) DOT/TSC 4/21/84

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED****

SITE: 5H (HARD) - 150 M. NORTH JUNE 6,1983

HOVER-OUT-OF-GROUND-EFFECT

BAND NO.	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES)								AVERAGE LEVEL OVER 360 DEGREES			
	0	45	90	135	180	225	270	315	ENERGY *	AVE **	ARITH ***	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal											
14	84.5	81.2	84.8	86.1	8[illegible].4	83.2	83.3	85.0	84.2	39.5	83.9	1.5
15	68.5	62.0	67.6	67.8	64.8	59.7	60.2	65.5	65.6	26.2	64.5	3.5
16	69.9	66.7	68.8	68.3	68.[illegible]	68.7	66.2	68.2	68.2	33.6	68.1	1.2
17	79.4	77.5	77.8	77.3	77.3	78.1	75.6	77.0	77.6	47.4	77.5	1.1
18	70.7	70.1	68.3	72.6	73.5	73.3	70.7	71.6	71.6	45.4	71.3	1.8
19	71.1	71.5	69.2	74.9	75.1	75.1	72.5	71.8	73.1	50.6	72.6	2.2
20	70.0	69.9	62.2	68.6	68.7	68.9	67.7	73.1	69.4	50.3	68.6	3.1
21	71.3	72.7	61.8	71.3	71.5	72.2	70.7	75.4	71.9	55.8	70.9	3.9
22	73.3	74.6	64.8	74.2	74.6	75.9	74.3	75.3	74.2	60.8	73.4	3.5
23	76.2	76.9	67.3	75.3	76.9	77.6	77.4	76.8	76.3	65.4	75.5	3.4
24	76.9	77.7	68.1	75.9	79.1	79.1	79.1	78.3	77.6	69.0	76.8	3.7
25	74.7	76.8	64.5	73.8	77.6	76.9	77.9	76.1	75.9	69.3	74.8	4.4
26	72.8	75.9	61.5	71.2	76.1	75.2	75.4	72.8	74.0	69.2	72.6	4.8
27	68.6	72.8	58.5	67.4	73.9	71.8	72.8	68.4	70.9	67.7	69.3	5.0
28	68.8	68.9	59.0	67.9	70.5	67.8	68.6	68.2	68.2	66.3	67.5	3.5
29	72.3	70.0	63.9	71.7	67.6	69.4	66.9	72.1	70.0	69.2	69.2	2.9
30	75.0	73.0	66.1	81.5	77.6	79.2	75.7	78.5	77.5	77.5	75.8	4.7
31	71.7	72.5	66.0	71.8	71.4	75.5	72.7	72.9	72.4	73.0	71.8	2.7
32	68.6	71.3	63.5	69.0	71.7	72.3	72.3	68.6	70.4	71.4	69.7	3.0
33	70.1	71.0	63.6	74.8	79.3	80.5	77.2	76.2	76.4	77.6	74.1	5.6
34	66.1	66.1	60.3	66.9	70.6	73.2	70.4	69.8	69.2	70.5	67.9	4.0
35	66.6	66.2	58.7	68.8	74.9	77.2	73.3	75.3	72.9	74.1	70.1	6.2
36	63.8	63.8	56.5	65.6	70.9	72.4	70.0	70.0	68.6	69.6	66.6	5.3
37	60.7	60.2	54.0	62.1	68.2	68.8	66.4	64.8	65.1	65.6	63.1	4.9
38	58.4	57.8	52.1	59.4	64.3	66.1	63.0	61.6	61.9	61.8	60.3	4.4
39	58.6	56.5	49.7	56.3	59.8	62.1	59.1	58.5	58.6	57.5	57.6	3.7
40	64.1	63.6	51.9	53.2	54.9	57.1	56.5	65.5	61.0	58.5	58.3	5.3
AL	81.4	81.8	73.7	84.3	85.5	86.8	84.4	84.6	83.9	83.9	82.8	4.1
OASPL	88.5	87.7	86.3	89.6	89.5	90.0	88.9	89.6	88.9	-	88.8	1.2
PNL	94.0	94.6	86.5	95.9	99.3	100.3	98.0	98.4	97.4	-	95.9	4.4
PNLT	95.0	96.0	87.2	99.1	102.0	102.9	99.9	100.8	99.6	-	97.9	5.1

BANDS 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz

* - UNWEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
** - A-WEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - UNWEIGHTED ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES

**** - 32 SECOND AVERGING TIME

TABLE NO. C.1-5H.2

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
4/21/84

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED****

SITE: 5H (HARD) - 150 M. NORTH JUNE 6,1983

FLIGHT IDLE

BAND NO.	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	AVERAGE LEVEL OVER 360 DEGREES ENERGY *	AVE **	ARITH ***	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal											
14	-	76.5	76.2	78.3	77.4	76.9	77.2	-	77.1	32.4	77.1	0.7
15	-	63.6	60.0	62.7	63.3	59.3	59.6	-	61.8	22.4	61.4	2.0
16	-	65.2	65.2	64.6	65.3	63.6	66.1	-	65.1	30.5	65.0	0.8
17	-	71.4	74.1	71.9	71.8	70.8	72.6	-	72.2	42.0	72.1	1.1
18	-	66.7	67.4	63.3	65.2	65.7	67.6	-	66.2	40.0	66.0	1.6
19	-	62.2	63.6	61.6	59.4	60.7	61.9	-	61.8	39.3	61.6	1.4
20	-	64.5	68.0	64.8	59.7	63.8	64.4	-	64.8	45.7	64.2	2.7
21	-	66.1	69.0	65.6	62.0	67.3	65.9	-	66.4	50.3	66.0	2.3
22	-	66.8	70.1	67.0	65.2	67.0	67.7	-	67.6	54.2	67.3	1.6
23	-	69.0	72.8	68.0	67.8	68.1	71.3	-	69.9	59.0	69.5	2.1
24	-	69.4	72.7	68.1	70.0	68.1	71.7	-	70.3	61.7	70.0	1.9
25	-	68.4	71.5	67.5	68.3	66.5	70.8	-	69.2	62.6	68.8	1.9
26	-	68.1	70.4	66.8	66.8	64.5	68.4	-	67.9	63.1	67.5	2.0
27	-	66.7	71.0	65.6	66.6	63.2	68.3	-	67.6	64.4	66.9	2.6
28	-	65.2	72.7	62.8	65.1	61.2	70.1	-	68.1	66.2	66.2	4.4
29	-	64.9	71.0	62.5	63.9	61.1	69.1	-	66.9	66.1	65.4	3.9
30	-	64.9	68.7	66.9	68.7	68.2	70.0	-	68.2	68.2	67.9	1.8
31	-	62.3	68.1	61.1	64.3	61.0	67.8	-	65.1	65.7	64.1	3.2
32	-	63.4	68.9	60.4	64.3	61.7	67.1	-	65.3	66.3	64.3	3.2
33	-	62.7	67.8	63.9	65.7	67.1	66.8	-	66.0	67.2	65.7	2.0
34	-	59.0	65.4	57.8	61.2	58.4	63.6	-	61.8	63.1	60.9	3.1
35	-	58.9	64.7	60.8	63.8	62.7	63.1	-	62.7	63.9	62.3	2.1
36	-	56.2	62.8	58.2	61.0	57.6	60.3	-	59.9	60.9	59.3	2.4
37	-	53.8	60.6	54.2	57.1	53.3	58.1	-	57.0	57.5	56.2	2.9
38	-	54.0	59.1	51.6	54.4	50.4	56.6	-	55.3	55.2	54.3	3.2
39	-	60.4	59.8	51.5	54.0	51.4	55.9	-	56.9	55.8	55.5	3.9
40	-	62.1	56.7	45.1	47.2	46.0	52.6	-	56.0	53.5	51.6	6.8
AL	-	74.5	79.4	73.8	75.8	74.5	78.0	-	76.5	76.5	76.0	2.2
OASPL	-	81.4	84.0	81.7	81.6	81.0	83.0	-	82.2	-	82.1	1.1
PNL	-	87.3	91.9	86.7	88.7	87.9	90.3	-	89.3	-	88.8	2.0
PNLT	-	87.7	92.3	88.4	90.3	90.3	90.6	-	89.9	-	87.9	1.7

BANDS 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz

* - UNWEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
** - A-WEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - UNWEIGHTED ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES

**** - 32 SECOND AVERGING TIME

TABLE NO. C.1-5H.1

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
4/21/84

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED****

SITE: 5H (HARD) - 150 M. NORTH JUNE 6,1983

HOVER-IN-GROUND-EFFECT

BAND NO.	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	AVERAGE LEVEL OVER 360 DEGREES ENERGY *	AVE **	ARITH ***	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal											
14	80.0	76.1	80.6	82.4	80.1	79.9	81.0	81.4	80.5	35.8	80.2	1.9
15	65.8	62.7	61.6	66.4	64.8	68.4	67.4	65.0	65.8	26.4	65.3	2.3
16	66.0	65.8	65.2	66.7	66.3	67.9	68.2	66.0	66.6	32.0	66.5	1.0
17	74.0	75.4	75.7	74.6	74.5	74.1	76.1	74.5	74.9	44.7	74.9	0.8
18	66.0	68.6	67.2	70.3	68.9	69.0	69.5	65.6	68.4	42.2	68.1	1.7
19	65.5	69.1	68.3	71.8	69.8	69.6	69.6	65.8	69.1	46.6	68.7	2.1
20	64.2	66.6	63.5	65.5	65.3	66.0	67.6	63.4	65.5	46.4	65.3	1.5
21	65.7	67.8	63.7	67.6	67.9	67.7	68.1	65.0	66.9	50.8	66.7	1.7
22	67.2	70.1	64.6	69.5	69.4	69.2	68.9	66.6	68.5	55.1	68.2	1.9
23	68.7	72.5	66.4	70.8	71.5	69.8	70.1	68.3	70.1	59.2	69.8	1.9
24	69.4	73.9	68.3	71.1	72.5	70.1	71.3	68.7	71.0	62.4	70.7	1.9
25	69.4	73.1	68.3	70.2	71.6	69.1	71.3	68.1	70.5	63.9	70.1	1.7
26	69.2	72.2	69.7	69.3	71.2	69.5	71.1	68.0	70.2	65.4	70.0	1.4
27	68.1	71.9	69.2	68.2	70.3	68.6	70.8	67.6	69.6	66.4	69.3	1.5
28	65.4	70.8	66.9	66.8	67.6	66.8	69.1	65.2	67.7	65.8	67.3	1.9
29	63.8	69.3	66.0	66.8	66.4	66.3	67.3	63.6	66.5	65.7	66.2	1.8
30	65.9	70.1	65.1	75.7	75.2	72.7	73.4	67.0	72.2	72.2	70.6	4.2
31	63.1	66.9	63.4	66.9	67.2	66.0	67.8	64.2	66.0	66.6	65.7	1.8
32	62.0	66.0	63.0	65.4	64.8	63.8	66.0	61.3	64.3	65.3	64.0	1.8
33	61.4	66.4	61.1	69.3	70.8	69.0	69.0	64.5	67.6	68.8	66.4	3.7
34	57.0	62.2	56.7	62.9	62.4	60.9	62.3	58.5	60.9	62.2	60.4	2.6
35	57.7	63.5	55.2	65.4	67.0	64.8	63.6	61.0	63.6	64.8	62.3	4.0
36	55.0	61.2	52.5	62.5	62.5	59.3	59.6	56.0	59.7	60.7	58.6	3.7
37	52.2	58.4	50.4	59.9	58.5	55.6	55.9	52.8	56.5	57.0	55.5	3.4
38	50.4	56.4	49.2	57.5	55.0	53.7	53.5	50.8	54.2	54.1	53.3	3.0
39	51.4	55.7	47.5	53.9	51.2	49.9	50.1	48.9	51.8	50.7	51.1	2.7
40	57.5	63.6	49.7	50.4	47.2	-	50.2	56.4	57.2	54.7	53.6	5.8
AL	74.3	78.7	74.5	79.5	79.8	77.9	78.9	74.7	77.8	77.8	77.3	2.4
DASPL	83.2	84.2	83.6	85.8	85.0	84.2	85.3	83.9	84.5	-	84.4	0.9
PNL	86.4	91.1	86.1	91.6	92.2	90.5	91.2	87.5	90.3	-	89.6	2.5
PNLT	87.3	92.6	86.6	94.6	95.0	92.7	93.1	89.1	92.3	-	91.4	3.3

BANDS 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz

* - UNWEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
** - A-WEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - UNWEIGHTED ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES

**** - 32 SECOND AVERGING TIME

TABLE NO. C.1-4H.4

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
4/21/84

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED****

SITE: 4H (SOFT) - 300 M. WEST JUNE 6,1983

HOVER-OUT-OF-GROUND-EFFECT

BAND NO.	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES)								AVERAGE LEVEL OVER 360 DEGREES			
	0	45	90	135	180	225	270	315	ENERGY *	AVE **	ARITH ***	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal											
14	73.9	71.5	75.1	74.5	73.3	73.3	75.2	77.0	74.5	29.8	74.2	1.6
15	55.1	53.4	52.6	54.8	57.5	58.1	57.3	55.2	55.9	16.5	55.5	2.0
16	56.8	56.6	59.9	56.1	59.3	60.2	59.0	58.5	58.5	23.9	58.3	1.6
17	66.5	66.5	70.2	63.9	67.5	68.9	68.4	69.4	68.0	37.8	67.7	2.0
18	58.0	60.3	64.7	64.4	64.5	63.5	62.9	61.4	63.0	36.8	62.5	2.4
19	59.6	62.0	66.2	67.0	66.3	65.1	65.0	63.2	64.8	42.3	64.3	2.5
20	55.0	57.5	64.0	57.9	56.5	62.1	62.1	59.2	60.3	41.2	59.3	3.1
21	53.4	57.2	61.6	59.5	57.4	60.6	61.6	59.6	59.5	43.4	58.9	2.8
22	54.8	57.9	60.5	61.6	58.5	61.4	60.5	58.9	59.7	46.3	59.3	2.3
23	55.1	59.6	60.4	60.8	58.3	62.4	60.4	59.3	59.9	49.0	59.5	2.2
24	54.1	59.8	59.1	59.5	60.2	63.0	60.7	60.2	60.1	51.5	59.6	2.5
25	51.6	56.9	55.9	56.3	58.1	57.8	58.5	56.8	56.9	50.3	56.5	2.2
26	50.2	53.6	54.0	54.8	54.6	59.1	58.5	54.9	55.7	50.9	55.0	2.8
27	53.6	57.9	56.1	58.0	56.3	63.6	62.0	58.9	59.4	56.2	58.3	3.2
28	56.0	61.5	60.5	60.9	59.2	64.6	63.1	60.6	61.4	59.5	60.8	2.6
29	58.0	64.5	62.9	64.2	62.2	65.3	63.9	62.0	63.3	62.5	62.9	2.3
30	65.4	68.9	65.6	66.8	71.9	68.7	68.2	65.5	68.2	68.2	67.6	2.3
31	57.9	64.3	63.9	64.2	64.5	62.2	61.7	60.3	62.9	63.5	62.4	2.4
32	53.9	60.3	62.6	62.5	62.7	61.1	58.9	60.2	60.9	61.9	60.3	2.9
33	57.7	62.8	60.9	63.5	68.1	65.6	62.3	60.8	63.7	64.9	62.7	3.2
34	54.0	60.0	57.3	59.0	59.3	59.3	56.6	57.2	58.2	59.5	57.8	2.0
35	52.3	58.7	56.7	59.3	63.8	61.4	58.4	56.5	59.5	60.7	58.4	3.4
36	48.4	54.6	52.9	55.1	58.2	55.5	53.4	52.5	54.6	55.6	53.8	2.8
37	44.3	49.7	49.4	50.3	53.3	50.7	47.5	47.8	49.8	50.3	49.1	2.7
38	39.8	44.2	44.6	44.8	47.6	45.3	42.1	42.6	44.4	44.3	43.9	2.4
39	35.6	38.8	38.9	38.5	40.8	38.9	-	37.5	38.7	37.6	38.4	1.6
40	35.0	38.1	-	-	-	-	-	37.9	37.2	34.7	37.0	1.7
AL	68.5	73.3	71.8	72.9	75.8	74.1	72.6	70.9	72.9	72.9	72.5	2.2
OASPL	76.0	76.7	78.6	78.0	78.7	78.5	78.6	79.0	78.1	-	78.0	1.1
PNL	78.7	83.9	83.0	84.4	87.0	86.0	83.7	82.4	84.4	-	83.6	2.5
PNLT	81.2	85.4	83.5	85.4	89.8	87.8	85.5	83.8	86.1	-	85.3	2.6

BANDS 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz

* - UNWEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
** - A-WEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - UNWEIGHTED ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES

**** - 32 SECOND AVERGING TIME

TABLE NO. C.1-4H.2

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED****

DOT/TSC
4/21/84

SITE: 4H (SOFT) - 300 M. WEST JUNE 6,1983

FLIGHT IDLE

BAND NO.	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	AVERAGE LEVEL OVER 360 DEGREES ENERGY *	AVE **	ARITH ***	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal											
14	71.2	71.6	70.2	71.2	69.7	-	70.9	71.1	70.9	26.2	70.8	0.7
15	49.3	51.2	52.0	55.9	55.2	-	47.8	51.0	52.6	13.2	51.8	2.9
16	56.3	57.8	58.6	58.9	58.3	-	59.5	52.2	57.8	23.2	57.4	2.5
17	66.4	66.2	66.8	66.1	64.5	-	66.4	59.7	65.6	35.4	65.2	2.5
18	58.1	60.3	64.0	59.5	59.0	-	61.0	61.7	60.9	34.7	60.5	2.0
19	55.4	56.9	59.5	55.7	54.1	-	56.5	61.3	57.7	35.2	57.1	2.5
20	57.6	59.2	62.1	58.0	55.0	-	59.6	68.7	62.4	43.3	60.0	4.4
21	58.6	59.8	60.9	61.8	55.7	-	60.8	69.6	63.3	47.2	61.0	4.3
22	58.1	59.4	59.4	55.5	56.9	-	60.2	65.6	60.5	47.1	59.3	3.2
23	56.3	57.4	58.9	55.4	56.9	-	58.5	61.8	58.4	47.5	57.9	2.1
24	47.4	51.4	52.3	52.2	53.2	-	51.5	52.7	51.8	43.2	51.5	1.9
25	40.1	43.7	43.2	47.6	46.2	-	45.6	50.1	46.2	39.6	45.2	3.2
26	40.3	42.0	39.9	43.6	39.3	-	45.2	50.0	44.6	39.8	42.9	3.8
27	42.1	41.6	43.2	44.2	38.6	-	45.9	53.1	46.7	43.5	44.1	4.6
28	44.1	43.1	48.1	41.8	38.9	-	49.7	55.1	49.0	47.1	45.8	5.5
29	49.2	48.0	49.7	39.9	41.0	-	54.8	61.5	54.5	53.7	49.2	7.5
30	52.2	51.4	52.3	47.9	49.4	-	63.6	66.0	59.9	59.9	54.7	7.1
31	52.6	51.8	51.8	40.9	43.6	-	56.7	60.7	54.9	55.5	51.2	6.9
32	54.0	53.8	53.4	42.1	46.6	-	56.6	61.3	55.7	56.7	52.5	6.4
33	52.9	53.1	53.4	48.6	49.2	-	59.3	60.2	55.8	57.0	53.8	4.5
34	48.9	49.5	50.0	40.8	44.2	-	54.0	55.1	51.0	52.3	48.9	5.1
35	47.9	49.0	50.5	45.8	47.7	-	55.4	54.6	51.5	52.7	50.1	3.6
36	43.8	44.9	48.1	42.7	44.2	-	50.0	50.7	47.4	48.4	46.3	3.2
37	-	40.8	44.2	37.6	-	-	45.4	44.6	43.3	43.8	42.5	3.3
38	-	37.2	39.1	-	-	-	-	39.2	38.6	38.5	38.5	1.1
39	-	39.4	37.2	-	-	-	-	37.6	38.2	37.1	38.1	1.2
40	-	38.4	-	-	-	-	-	38.1	38.3	35.8	38.2	0.2
AL	61.5	61.5	62.2	56.6	57.6	-	67.8	70.7	65.2	65.2	62.6	5.1
OASPL	73.5	74.1	74.1	73.6	72.2	-	74.6	76.9	74.4	-	74.1	1.4
PNL	74.1	74.7	75.6	70.8	71.6	-	79.4	81.8	77.4	-	75.4	4.0
PNLT	74.5	75.1	76.0	73.2	74.0	-	82.1	83.4	79.1	-	76.9	4.1

BANDS 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz

* - UNWEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
** - A-WEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - UNWEIGHTED ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES

**** - 32 SECOND AVERGING TIME

TABLE NO. C.1-4H.1

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
4/21/84

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED****

SITE: 4H (SOFT) - 300 M. WEST JUNE 6,1983

HOVER-IN-GROUND-EFFECT

BAND NO.	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES)								AVERAGE LEVEL OVER 360 DEGREES			
	0	45	90	135	180	225	270	315	ENERGY *	AVE **	ARITH ***	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal											
14	73.7	66.7	73.2	73.2	74.2	72.8	74.3	75.2	73.4	28.7	72.9	2.6
15	53.5	50.3	52.4	53.9	52.7	56.6	54.6	52.3	53.6	14.2	53.3	1.9
16	57.1	57.2	58.4	56.6	59.6	60.2	58.8	55.8	58.2	23.6	58.0	1.5
17	68.4	68.5	68.9	65.6	69.9	70.2	68.9	66.8	68.6	38.4	68.4	1.5
18	61.4	62.6	64.5	64.3	65.2	65.5	64.0	60.7	63.8	37.6	63.5	1.8
19	63.0	64.1	67.3	67.6	67.5	67.6	65.3	62.7	66.1	43.6	65.6	2.1
20	60.7	61.5	61.4	60.3	62.9	64.0	63.4	61.9	62.2	43.1	62.0	1.3
21	61.5	62.9	63.5	62.2	64.8	65.1	64.4	63.5	63.6	47.5	63.5	1.3
22	61.4	64.0	64.4	63.9	65.7	66.2	64.3	63.2	64.3	50.9	64.1	1.5
23	58.4	62.9	63.1	62.7	64.2	63.4	61.5	61.0	62.4	51.5	62.1	1.8
24	51.3	55.4	56.8	59.3	59.6	55.7	52.2	52.6	56.3	47.7	55.4	3.2
25	49.0	47.7	49.1	51.8	54.1	45.7	46.3	45.6	49.7	43.1	48.7	3.0
26	49.8	48.7	49.8	48.9	53.0	45.1	46.9	45.8	49.2	44.4	48.5	2.5
27	52.9	54.4	53.6	51.8	54.1	48.7	51.8	50.3	52.6	49.4	52.2	2.0
28	56.7	58.2	58.0	54.0	55.9	51.9	55.9	54.6	56.1	54.2	55.6	2.1
29	60.7	62.0	62.5	56.6	58.4	55.7	59.1	59.1	59.8	59.0	59.3	2.4
30	63.3	65.4	65.8	60.3	66.7	65.3	66.0	63.4	64.9	64.9	64.5	2.1
31	60.4	64.7	64.8	58.7	61.3	62.2	61.3	59.9	62.2	62.8	61.7	2.2
32	58.8	63.2	64.4	58.7	61.1	60.9	59.3	56.1	61.0	62.0	60.3	2.7
33	57.6	60.2	61.8	59.1	68.2	66.2	60.4	56.4	63.1	64.3	61.2	4.1
34	53.1	55.8	56.9	53.8	60.5	57.0	54.0	52.5	56.2	57.5	55.4	2.7
35	52.7	54.8	55.1	55.4	64.9	58.8	54.6	53.5	58.4	59.6	56.2	3.9
36	48.6	50.7	51.1	52.0	59.6	52.9	50.1	47.6	53.4	54.4	51.6	3.7
37	44.9	45.9	47.5	48.1	54.8	47.2	44.4	42.9	48.7	49.2	47.0	3.6
38	40.3	40.8	43.1	43.1	48.4	40.9	39.5	38.2	43.0	42.9	41.8	3.1
39	37.3	36.5	37.9	37.8	41.6	-	-	-	38.6	37.5	38.2	2.0
40	37.6	37.0	-	-	-	-	-	-	37.3	34.8	37.3	0.4
AL	68.7	71.6	72.2	67.9	74.1	71.9	70.2	61.0	71.1	71.1	70.6	2.2
OASPL	76.7	75.8	77.9	76.7	79.0	78.2	77.8	77.4	77.5	-	77.4	1.0
PNL	79.6	82.3	83.2	80.8	87.1	84.6	81.3	78.8	83.3	-	82.2	2.7
PNLT	80.6	82.8	83.9	81.7	89.6	87.0	83.2	80.1	84.8	-	83.6	3.2

BANDS 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz

* - UNWEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
** - A-WEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - UNWEIGHTED ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES

**** - 32 SECOND AVERGING TIME

TABLE NO. C.1-2H.4

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED****

DOT/TSC
4/21/84

SITE: 2 (SOFT) - 150 M. WEST JUNE 6,1983

HOVER-OUT-OF-GROUND-EFFECT

BAND NO.	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	AVERAGE LEVEL OVER 360 DEGREES ENERGY *	AVE **	ARITH ***	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal											
14	84.5	84.0	85.3	84.7	83.6	84.3	86.0	86.7	85.0	40.3	84.9	1.0
15	60.0	59.3	60.4	59.2	59.8	62.5	63.2	62.3	61.1	21.7	60.8	1.6
16	65.9	65.7	69.3	64.8	67.8	68.9	67.8	66.6	67.4	32.[illegible]	67.1	1.6
17	77.3	77.2	80.0	74.1	77.7	78.8	79.2	77.8	78.0	47.8	77.8	1.8
18	67.0	68.9	72.7	72.0	72.8	73.7	71.8	70.4	71.6	45.4	71.2	2.3
19	67.9	70.1	73.5	73.8	74.6	74.7	73.8	71.9	73.0	50.5	72.5	2.4
20	65.1	66.8	69.0	66.5	66.5	73.5	72.3	69.6	69.6	50.5	68.7	3.0
21	62.5	66.8	68.6	67.7	67.4	74.3	71.5	70.7	69.9	53.8	68.7	3.5
22	61.6	67.6	70.0	70.0	68.4	73.4	71.2	70.2	70.0	56.6	69.0	3.5
23	61.2	67.3	71.8	70.0	68.2	72.8	71.5	70.1	70.1	59.2	69.1	3.7
24	60.6	65.1	70.9	69.8	68.2	68.9	7[illegible].4	68.6	68.7	60.1	67.8	3.4
25	55.5	61.1	65.8	66.3	61.9	67.5	65.9	64.6	64.7	58.1	63.6	3.9
26	60.8	66.5	62.1	62.7	63.8	73.7	6[illegible].3	66.4	67.8	63.0	65.7	4.3
27	66.4	70.9	66.0	65.7	68.4	76.3	72.6	70.6	71.1	67.9	69.6	3.7
28	68.7	72.1	70.6	68.2	69.6	75.7	74.0	71.7	72.0	70.1	71.3	2.6
29	67.7	70.3	71.8	70.4	69.2	71.8	72.5	70.1	70.7	69.9	70.5	1.6
30	69.5	71.2	74.7	73.5	76.8	71.7	73.6	71.6	73.4	73.4	72.8	2.3
31	67.3	70.9	70.5	69.5	67.8	72.2	67.2	69.7	69.7	70.3	69.4	1.8
32	68.0	69.6	68.7	68.1	68.2	70.2	67.6	70.2	68.9	69.9	68.8	1.0
33	66.7	69.6	68.4	68.8	75.4	73.7	69.8	69.1	71.1	72.3	70.2	2.9
34	64.8	67.3	66.0	66.0	67.1	68.8	64.1	66.6	66.6	67.9	66.3	1.5
35	64.3	66.6	65.1	65.3	71.9	70.5	64.5	65.6	67.8	69.0	66.8	2.8
36	60.9	63.4	61.7	62.6	67.4	66.6	62.5	62.6	64.1	65.1	63.5	2.3
37	57.5	60.0	59.2	58.8	63.3	62.1	57.2	58.8	60.1	60.6	59.6	2.1
38	54.2	56.1	56.5	55.2	59.3	58.3	53.7	55.7	56.5	56.4	56.1	1.9
39	52.6	53.5	53.3	51.4	55.1	54.5	50.4	53.1	53.2	52.1	53.0	1.5
40	57.3	59.1	51.4	47.7	48.7	49.8	50.3	60.1	55.5	53.0	53.0	5.0
AL	77.2	79.9	80.1	79.3	82.2	82.6	80.3	79.7	80.4	80.4	80.2	1.7
DASPL	86.1	86.5	88.1	86.9	87.2	88.6	88.6	88.5	87.7	-	87.6	1.0
PNL	89.3	92.0	91.8	91.5	95.0	95.6	92.5	92.1	93.1	-	92.5	2.0
PNLT	90.3	93.4	93.0	92.7	97.8	97.0	93.7	93.7	94.3	-	93.9	2.4

BANDS 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz

* - UNWEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
** - A-WEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - UNWEIGHTED ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES

**** - 32 SECOND AVERGING TIME

TABLE NO. C.1-2H.2

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
4/21/84

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED****

SITE: 2 (SOFT) - 150 M. WEST JUNE 6,1983

FLIGHT IDLE

BAND NO.	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	AVERAGE LEVEL OVER 360 DEGREES ENERGY *	AVE **	ARITH ***	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal											
14	-	80.0	79.0	79.7	78.7	-	-	-	79.4	34.7	79.3	0.6
15	-	58.7	55.2	58.0	57.3	-	-	-	57.5	18.1	57.3	1.5
16	-	66.0	67.3	67.9	65.8	-	-	-	66.8	32.2	66.7	1.0
17	-	74.7	76.0	75.3	73.3	-	-	-	74.9	44.7	74.8	1.1
18	-	67.6	71.7	67.3	66.6	-	-	-	68.8	42.6	68.3	2.3
19	-	63.8	66.6	63.3	62.1	-	-	-	64.3	41.8	63.9	1.9
20	-	66.6	70.3	63.8	63.7	-	-	-	67.0	47.9	66.1	3.1
21	-	67.7	68.8	67.2	64.5	-	-	-	67.3	51.2	67.0	1.8
22	-	67.9	68.5	64.8	65.9	-	-	-	67.0	53.6	66.8	1.7
23	-	68.8	70.3	64.8	67.0	-	-	-	68.2	57.3	67.7	2.4
24	-	66.2	66.7	63.8	66.6	-	-	-	66.0	57.4	65.8	1.4
25	-	58.2	58.8	58.9	61.3	-	-	-	59.5	52.9	59.3	1.4
26	-	46.4	46.8	51.7	51.0	-	-	-	49.6	44.8	49.0	2.8
27	-	46.5	48.3	47.5	45.2	-	-	-	47.0	43.8	46.9	1.3
28	-	48.7	52.5	45.0	45.8	-	-	-	49.1	47.2	48.0	3.4
29	-	53.1	54.1	46.0	49.3	-	-	-	51.7	50.9	50.6	3.7
30	-	55.5	57.8	53.9	57.1	-	-	-	56.3	56.3	56.1	1.7
31	-	55.7	56.9	47.3	50.6	-	-	-	54.1	54.7	52.6	4.5
32	-	58.4	60.6	48.3	52.2	-	-	-	57.1	58.1	54.9	5.6
33	-	58.4	61.0	55.1	53.9	-	-	-	58.0	59.2	57.1	3.2
34	-	56.9	59.6	48.0	49.6	-	-	-	55.9	57.2	53.5	5.6
35	-	56.7	60.0	52.8	52.7	-	-	-	56.6	57.8	55.5	3.5
36	-	53.6	57.9	50.5	49.6	-	-	-	54.2	55.2	52.9	3.7
37	-	50.6	54.5	45.8	45.4	-	-	-	50.7	51.2	49.1	4.3
38	-	49.5	51.4	42.0	42.1	-	-	-	48.1	48.0	46.2	4.9
39	-	55.4	52.3	41.0	42.3	-	-	-	51.4	50.3	47.7	7.2
40	-	56.3	48.1	33.8	35.4	-	-	-	50.9	48.4	43.4	10.7
AL	-	68.4	70.4	64.1	65.5	-	-	-	67.8	67.8	67.1	2.8
OASPL	-	82.5	82.9	82.1	81.0	-	-	-	82.2	-	82.1	0.8
PNL	-	82.9	85.2	78.6	79.2	-	-	-	82.6	-	81.5	3.1
PNLT	-	83.3	85.7	81.0	81.6	-	-	-	83.7	-	82.9	2.1

BANDS 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz

* - UNWEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
** - A-WEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - UNWEIGHTED ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES

**** - 32 SECOND AVERGING TIME

TABLE NO. C.1-2H.1

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
4/24/84

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED****

SITE: 2 (SOFT) - 150 M. WEST JUNE 6,1983

HOVER-IN-GROUND-EFFECT

BAND NO.	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES)								AVERAGE LEVEL OVER 360 DEGREES			
	0	45	90	135	180	225	270	315	ENERGY *	AVE **	ARITH ***	Std Dv

SOUND PRESSURE LEVEL dB re 20 microPascal

*******NO DATA*******

TABLE NO. C.1-1H.4

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED****

DOT/TSC
4/21/84

SITE: 1H (SOFT) - 150 M. NW JUNE 6,1983

HOVER-OUT-OF-GROUND-EFFECT

BAND NO.	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	AVERAGE LEVEL OVER 360 DEGREES ENERGY *	AVE **	ARITH ***	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal											
14	81.8	79.2	81.5	81.6	80.2	80.8	83.0	82.5	81.5	36.8	81.3	1.2
15	58.2	56.6	59.4	59.4	59.9	59.8	62.7	62.4	60.2	20.8	59.8	2.0
16	64.5	62.9	62.0	62.1	64.7	65.4	66.6	65.6	64.5	29.9	64.2	1.7
17	75.4	73.2	70.4	70.5	73.1	74.0	75.6	75.6	73.9	43.7	73.5	2.1
18	67.3	65.4	69.2	69.1	70.1	69.2	71.4	67.5	69.0	42.8	68.6	1.9
19	68.0	67.2	72.2	72.0	71.9	71.3	71.5	69.5	70.8	48.3	70.4	2.0
20	66.3	61.2	65.4	64.8	63.6	64.9	69.7	66.8	66.0	46.9	65.3	2.5
21	66.5	62.7	66.0	66.4	64.9	66.6	70.9	68.1	67.1	51.0	66.5	2.4
22	66.5	63.8	67.1	67.1	66.2	68.2	70.3	67.7	67.5	54.1	67.1	1.8
23	66.1	64.1	66.4	66.5	65.9	66.8	69.5	67.4	66.8	55.9	66.6	1.5
24	63.1	63.1	64.5	64.7	64.3	64.6	65.2	65.7	64.5	55.9	64.4	0.9
25	57.6	56.1	57.9	58.3	57.0	57.4	66.3	59.9	60.3	53.7	58.8	3.2
26	64.7	60.3	59.6	60.6	62.2	59.5	72.2	63.1	65.3	60.5	62.8	4.2
27	68.4	65.9	63.8	64.8	66.1	63.0	75.2	66.7	68.8	65.6	66.7	3.8
28	70.2	68.4	65.8	66.4	68.0	64.7	74.9	68.7	69.6	67.7	68.4	3.2
29	70.6	69.3	68.8	69.0	69.4	67.3	74.0	69.8	70.2	69.4	69.8	1.9
30	71.6	76.7	74.7	73.8	79.7	76.0	73.9	73.1	75.6	75.6	74.9	2.5
31	65.7	66.8	70.2	69.8	69.3	70.7	69.2	67.2	68.9	69.5	68.6	1.8
32	67.1	65.7	66.2	66.5	66.0	64.9	72.6	66.1	67.7	68.7	66.9	2.4
33	66.7	69.9	69.7	68.9	74.3	73.5	70.9	68.4	71.0	72.2	70.3	2.6
34	62.9	63.5	65.0	64.8	66.0	67.0	68.3	63.6	65.5	66.8	65.1	1.9
35	62.5	64.8	67.2	67.3	70.9	70.5	67.2	63.6	67.6	68.8	66.7	3.0
36	59.7	61.1	63.6	63.2	66.7	65.9	64.7	60.7	63.8	64.8	63.2	2.5
37	56.9	58.2	61.2	60.5	64.0	62.2	61.4	57.5	60.8	61.3	60.2	2.5
38	53.9	55.3	58.3	57.7	60.7	57.0	58.0	55.0	57.8	57.7	57.2	2.3
39	53.7	53.8	55.0	54.5	56.7	55.1	54.3	53.7	54.7	53.6	54.6	1.0
40	58.4	59.6	50.0	49.9	50.9	50.3	54.2	62.4	57.1	54.6	54.5	5.0
AL	77.8	79.8	79.4	79.0	82.8	81.0	82.1	78.3	80.3	80.3	80.0	1.8
OASPL	84.6	83.4	84.5	84.4	85.5	84.9	87.0	85.2	85.0	-	84.9	1.0
PNL	89.5	90.6	91.3	91.2	94.0	93.2	93.8	90.5	92.3	-	91.8	1.7
PNLT	90.7	93.5	93.1	92.7	97.5	95.7	94.6	92.1	94.3	-	93.7	2.1

BANDS 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz

* - UNWEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
** - A-WEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - UNWEIGHTED ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES

**** - 32 SECOND AVERGING TIME

TABLE NO. C.1-1H.2

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
4/21/84

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED****

SITE: 1H (SOFT) - 150 M. NW JUNE 6,1983

FLIGHT IDLE

BAND NO.	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	AVERAGE LEVEL OVER 360 DEGREES ENERGY *	AVE **	ARITH ***	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal											
14	75.3	-	75.5	72.6	76.6	75.9	-	75.6	75.4	30.7	75.2	1.4
15	60.1	-	58.4	49.1	52.6	52.4	-	59.9	57.2	17.8	55.4	4.6
16	64.2	-	64.2	57.5	62.5	62.8	-	63.5	62.9	28.3	62.4	2.5
17	71.0	-	71.7	65.0	69.8	69.2	-	67.8	69.6	39.4	69.1	2.4
18	63.0	-	67.8	58.1	65.6	64.5	-	63.8	64.7	38.5	63.8	3.3
19	59.0	-	63.6	56.8	59.7	60.4	-	59.5	60.3	37.8	59.8	2.2
20	63.7	-	67.7	61.7	61.5	62.7	-	64.1	64.1	45.0	63.6	2.3
21	66.3	-	67.3	61.4	62.0	63.5	-	67.3	65.3	49.2	64.6	2.7
22	64.9	-	66.6	61.8	63.7	64.9	-	67.3	65.2	51.8	64.9	2.0
23	64.3	-	67.0	61.8	64.9	64.3	-	66.6	65.1	54.2	64.8	1.9
24	58.7	-	61.4	57.6	62.3	60.3	-	59.0	60.2	51.6	59.9	1.8
25	45.7	-	49.0	46.1	53.8	50.4	-	45.2	49.5	42.9	48.4	3.4
26	46.0	-	44.7	36.4	45.5	40.6	-	46.0	44.3	39.5	43.2	3.9
27	48.3	-	49.6	39.6	43.0	41.5	-	50.6	47.2	44.0	45.4	4.6
28	50.4	-	54.2	43.1	45.0	43.2	-	54.3	50.8	48.9	48.4	5.3
29	55.9	-	57.0	46.8	48.4	46.8	-	61.2	56.0	55.2	52.7	6.1
30	58.6	-	61.1	51.8	57.2	53.5	-	67.7	61.7	61.7	58.3	5.7
31	58.8	-	62.0	52.3	53.2	50.8	-	64.0	59.5	60.1	56.8	5.5
32	58.8	-	64.9	55.3	55.6	53.6	-	63.3	60.6	61.6	58.6	4.6
33	53.2	-	63.9	57.1	58.9	58.1	-	60.7	59.8	61.0	58.6	3.6
34	52.3	-	59.9	53.0	55.8	55.3	-	57.3	56.4	57.7	55.6	2.8
35	48.7	-	58.4	53.7	57.8	58.0	-	56.5	56.5	57.7	55.5	3.8
36	45.7	-	56.3	51.9	56.2	55.7	-	51.7	54.1	55.1	52.9	4.1
37	43.3	-	53.5	48.5	52.5	51.9	-	48.2	50.8	51.3	49.6	3.8
38	42.8	-	51.4	45.8	49.5	48.9	-	46.3	48.3	48.2	47.4	3.1
39	47.2	-	52.7	49.9	50.9	48.9	-	50.4	50.3	49.2	50.0	1.9
40	48.3	-	50.9	41.0	43.5	41.8	-	53.4	48.8	46.3	46.5	5.1
AL	66.4	-	71.9	64.5	67.2	66.3	-	72.3	69.1	69.1	68.1	3.2
DASPL	78.4	-	79.8	75.0	78.8	78.2	-	79.2	78.5	-	78.2	1.7
PNL	79.2	-	85.2	78.3	81.7	81.2	-	83.5	82.1	-	81.5	2.6
PNLT	79.8	-	85.7	79.4	83.8	82.7	-	85.2	83.4	-	82.8	2.7

BANDS 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz

* - UNWEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
** - A-WEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - UNWEIGHTED ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES

**** - 32 SECOND AVERGING TIME

TABLE NO. C.1-1H.1

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN) — DOT/TSC 4/21/84

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED****

SITE: 1H (SOFT) - 150 M. NW JUNE 6,1983

HOVER-IN-GROUND-EFFECT

BAND NO.	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	AVERAGE LEVEL OVER 360 DEGREES ENERGY *	AVE **	ARITH ***	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal											
14	78.7	74.7	77.8	79.4	77.9	78.3	78.9	-	78.2	33.5	78.0	1.5
15	63.3	59.6	62.0	59.4	59.2	55.7	61.4	-	60.6	21.2	60.1	2.5
16	64.0	63.0	63.7	61.8	63.4	62.7	63.8	-	63.3	28.7	63.2	0.8
17	72.4	72.5	73.0	70.2	72.1	71.6	72.7	-	72.2	42.0	72.1	0.9
18	66.0	66.9	67.0	69.0	68.4	68.5	67.7	-	67.8	41.6	67.6	1.1
19	66.2	67.9	69.2	71.9	70.2	71.0	69.1	-	69.7	47.2	69.4	1.9
20	65.0	65.4	65.5	64.9	66.2	68.3	66.5	-	66.1	47.0	66.0	1.2
21	67.1	67.6	67.5	67.9	68.7	70.8	68.0	-	68.4	52.3	68.2	1.2
22	67.1	68.5	68.9	69.6	69.3	71.4	68.7	-	69.2	55.8	69.1	1.3
23	65.3	67.8	68.4	68.6	68.1	69.8	67.8	-	68.1	57.2	68.0	1.4
24	59.4	63.0	63.1	63.7	63.3	64.1	62.6	-	62.9	54.3	62.7	1.6
25	47.2	50.0	49.4	52.0	50.3	51.9	49.0	-	50.2	43.6	50.0	1.7
26	46.3	45.1	47.2	50.1	44.3	45.6	43.8	-	46.6	41.8	46.1	2.1
27	49.5	48.5	50.7	49.1	49.4	50.1	46.0	-	49.2	46.0	49.0	1.5
28	54.7	52.4	54.8	52.3	52.3	54.1	48.3	-	53.1	51.2	52.7	2.2
29	59.4	58.4	59.8	57.0	55.6	58.4	51.4	-	57.8	57.0	57.1	2.9
30	64.1	64.3	64.2	62.7	64.1	69.4	61.8	-	65.1	65.1	64.4	2.4
31	64.2	64.4	64.4	60.1	60.6	65.8	59.1	-	63.3	63.9	62.7	2.6
32	60.6	62.0	60.9	60.3	60.5	64.4	59.5	-	61.5	62.5	61.2	1.6
33	54.7	57.1	56.0	61.2	61.4	69.7	58.1	-	63.0	64.2	59.7	5.1
34	53.5	51.6	53.5	53.4	52.0	61.4	51.0	-	55.5	56.8	53.8	3.5
35	50.5	52.2	49.4	55.7	56.4	62.4	52.5	-	56.4	57.6	54.2	4.4
36	47.7	48.4	46.9	51.5	52.0	57.2	48.4	-	51.8	52.8	50.3	3.6
37	45.1	45.4	44.6	48.6	48.4	53.1	44.9	-	48.3	48.8	47.2	3.1
38	42.7	42.8	42.6	45.2	45.1	49.3	42.0	-	45.0	44.9	44.2	2.6
39	43.1	41.6	40.3	42.1	41.4	45.6	39.4	-	42.4	41.3	41.9	2.0
40	48.3	49.1	41.3	38.4	36.6	41.4	39.0	-	44.5	42.0	42.0	4.9
AL	70.0	70.5	70.4	69.8	70.1	75.7	68.2	-	71.3	71.3	70.7	2.3
OASPL	81.2	79.8	81.2	82.0	81.3	82.5	81.6	-	81.4	-	81.4	0.8
PNL	81.3	82.2	81.7	83.1	83.0	88.7	80.8	-	84.1	-	83.0	2.7
PNLT	81.8	83.7	82.2	84.5	85.0	91.1	82.9	-	85.6	-	84.5	3.2

BANDS 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz

* - UNWEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
** - A-WEIGHTED ENERGY AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - UNWEIGHTED ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES

**** - 32 SECOND AVERGING TIME

APPENDIX C

Magnetic Recording Acoustical Data for Static Operations

This appendix contains time average, A-weighted sound level data along with time average, one-third octave sound pressure level information for eight different directivity emission angles. These data were acquired June 6 using the TSC magnetic recording system discussed in Section 5.6.1.

Thirty-two seconds of corrected raw spectral data (64 contiguous 1/2 second data records) have been energy averaged to produce the data tabulated in this appendix. The spectral data presented are "As Measured" for the given emission angles established relative to each microphone location. Also included in the tables are the 360 degree (eight emission angle) average levels, calculated by both arithmetic and energy averaging. The data reduction is further described in Section 6.1. Figure 6.1 (previously shown) provides the reader with a quick reference to the emission angle convention.

The data contained in these tables have been used in analyses presented in Sections 9.2 and 9.7. The reader may cross reference the magnetic recording data of this appendix with direct read static data presented in Appendix D.

HELICOPTER: DAUPHIN TABLE B-9.3

TEST DATE: 6-6-83

OPERATION: 9 DEGREE APPROACH

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
H52	93.3	85.2	12	7.5	.5
H53	88.9	79.6	16	7.7	.5
H54	90	81.1	16	7.4	.5
H55	92.1	84	13	7.3	.5
H56	90.5	81.4	16	7.6	.5
AVERAGE	91.00	82.30	14.60	7.50	.5
N	5	5	5	5	5
STD.DEV.	1.74	2.28	1.95	.17	.02
90% C.I.	1.66	2.18	1.86	.16	.02

HELICOPTER: DAUPHIN TABLE B.9.1

TEST DATE: 6-6-83

OPERATION: 9 DEGREE APPROACH

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
H52	94.3	88	NA	NA	NA
H53	96	90.1	NA	NA	NA
H54	95.5	89.8	NA	NA	NA
H55	96	91.2	NA	NA	NA
H56	94.9	89	NA	NA	NA
AVERAGE	95.30	89.60			
N	5	5			
STD.DEV.	0.74	1.20			
90% C.I.	0.70	1.14			

HELICOPTER: DAUPHIN TABLE B.9.2

TEST DATE: 6-6-83

OPERATION: 9 DEGREE APPROACH

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
H52	95.5	87.9	12	7	.5
H53	91	82.5	13	7.6	.5
H54	92.1	83.9	12	7.6	.6
H55	94.2	86.5	11	7.4	.5
H56	94.1	87	10	7.1	.5
AVERAGE	93.40	85.60	11.60	7.40	.5
N	5	5	5	5	5
STD.DEV.	1.80	2.27	1.14	.27	.03
90% C.I.	1.72	2.16	1.09	.26	.03

HELICOPTER: DAUPHIN TABLE B.8.2

TEST DATE: 6-6-83

OPERATION: DIRECT CLIMB TAKEOFF (BEST ANGLE OF CLIMB)

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
6B41	94.7	88.1	11	6.3	.4
6B42	94	87.6	10	6.4	.4
6B43	92.9	86.2	12	6.2	.4
6B44	93.7	86.7	12	6.5	.4
6B45	92.7	86	12	6.2	.4
AVERAGE	93.60	86.90	11.40	6.30	.4
N	5	5	5	5	5
STD.DEV.	0.82	0.90	0.89	.12	.02
90% C.I.	0.78	0.86	0.85	.12	.02

HELICOPTER: DAUPHIN TABLE B.8.3

TEST DATE: 6-6-83

OPERATION: DIRECT CLIMB TAKEOFF (BEST ANGLE OF CLIMB)

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
6B41	91.9	85	12	6.4	.4
6B42	91.9	85.1	12	6.3	.4
6B43	90.7	83.8	13	6.2	.4
6B44	90.8	83.8	12	6.5	.4
6B45	90.4	83	15	6.3	.4
AVERAGE	91.10	84.10	12.80	6.30	.4
N	5	5	5	5	5
STD.DEV.	0.71	0.89	1.30	.11	.02
90% C.I.	0.68	0.85	1.24	.11	.02

HELICOPTER: DAUPHIN TABLE B.7.3

TEST DATE: 6-6-83

OPERATION: DIRECT CLIMB TAKEOFF (BEST RATE OF CLIMB)

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
6A37	93.7	87.5	8	6.9	.5
6A38	94.2	88.6	8	6.2	.5
6A39	94.3	88.2	9	6.4	.5
6A40	93.6	87.2	9	6.7	.5
AVERAGE	94.00	87.90	8.50	6.50	.5
N	4	4	4	4	4
STD.DEV.	0.35	0.64	0.58	.3	.03
90% C.I.	0.41	0.75	0.68	.35	.04

HELICOPTER: DAUPHIN TABLE B.8.1

TEST DATE: 6-6-83

OPERATION: DIRECT CLIMB TAKEOFF (BEST ANGLE OF CLIMB)

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
6B41	96.5	91.3	NA	NA	NA
6B42	95.7	90.4	NA	NA	NA
6B43	94.7	89.5	NA	NA	NA
6B44	95.3	88.9	NA	NA	NA
6B45	94.7	88.4	NA	NA	NA
AVERAGE	95.40	89.70			
N	5	5			
STD.DEV.	0.76	1.16			
90% C.I.	0.72	1.11			

HELICOPTER: DAUPHIN TABLE B.7.1

TEST DATE: 6-6-83

OPERATION: DIRECT CLIMB TAKEOFF (BEST RATE OF CLIMB)

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
6A37	98.1	93.5	NA	NA	NA
6A38	97.7	92.9	NA	NA	NA
6A39	97.9	93.3	NA	NA	NA
6A40	96.9	92.2	NA	NA	NA
AVERAGE	97.70	93.00			
N	4	4			
STD.DEV.	0.53	0.57			
90% C.I.	0.62	0.68			

HELICOPTER: DAUPHIN TABLE B.7.2

TEST DATE: 6-6-83

OPERATION: DIRECT CLIMB TAKEOFF (BEST RATE OF CLIMB)

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
6A37	95.9	90.6	7	6.3	.5
6A38	96	90.6	7	6.4	.5
6A39	96.6	91.5	6	6.6	.5
6A40	96.1	90.6	7	6.5	.5
AVERAGE	96.20	90.80	6.80	6.40	.5
N	4	4	4	4	4
STD.DEV.	0.31	0.45	0.50	.13	.02
90% C.I.	0.37	0.53	0.59	.15	.03

HELICOPTER: DAUPHIN TABLE B.4.2

TEST DATE: 6-6-83

OPERATION: 1000 FT FLYOVER(0.9*VH)/TARGET IAS=135 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
D21	81.1	72	19	7.1	.4
D22	81.3	71.4	20	7.6	.5
D23	81.7	73.2	15	7.2	.5
D24	81.8	72	19	7.7	.5
D25	82.4	73.8	18	6.9	.4
AVERAGE	81.70	72.50	18.20	7.30	.5
N	5	5	5	5	5
STD.DEV.	0.50	0.99	1.92	.34	.04
90% C.I.	0.48	0.94	1.83	.33	.04

HELICOPTER: DAUPHIN TABLE B.4.3

TEST DATE: 6-6-83

OPERATION: 1000 FT FLYOVER(0.9*VH)/TARGET IAS=135 KTS

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
D21	81	72.1	18	7.1	.4
D22	80.7	70.4	22	7.7	.5
D23	81.6	73.1	15	7.2	.5
D24	81	71	20	7.7	.5
D25	82.4	74.5	14	6.9	.4
AVERAGE	81.30	72.20	17.80	7.30	.5
N	5	5	5	5	5
STD.DEV.	0.68	1.64	3.35	.35	.03
90% C.I.	0.65	1.57	3.19	.34	.03

HELICOPTER: DAUPHIN — TABLE B.5.1

TEST DATE: 6-6-83

OPERATION: ICAO TAKEOFF

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
E26	NA	NA	NA	NA	NA
E27	95.3	89.2	NA	NA	NA
E28	95.6	89.9	NA	NA	NA
E29	95.5	89	NA	NA	NA
E30	95.6	89.7	NA	NA	NA
E31	95.1	88.5	NA	NA	NA
E32	95.4	88.7	NA	NA	NA
E33	95.7	89.7	NA	NA	NA
E34	100.1	97.8	NA	NA	NA
AVERAGE	96.00	90.30			
N	8	8			
STD.DEV.	1.65	3.07			
90% C.I.	1.11	2.05			

HELICOPTER: DAUPHIN — TABLE B.5.2

TEST DATE: 6-6-83

OPERATION: ICAO TAKEOFF

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
E26	94.8	88	9	7.1	.5
E27	94.3	86.7	12	7	.5
E28	94.5	88.2	9	6.6	.5
E29	93.3	86.1	12	6.7	.4
E30	93.5	87.3	10	6.2	.4
E31	93.7	86.8	11	6.6	.4
E32	93.5	86.5	11	6.7	.5
E33	93.9	86.6	10	7.3	.5
E34	99.3	96.7	3	5.4	.6
AVERAGE	94.50	88.10	9.70	6.60	.5
N	9	9	9	9	9
STD.DEV.	1.86	3.30	2.74	.55	.06
90% C.I.	1.15	2.04	1.70	.34	.04

HELICOPTER: DAUPHIN TABLE B.5.3

TEST DATE: 6-6-83

OPERATION: ICAO TAKEOFF

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
E26	93.2	85.4	12	7.2	.5
E27	92.3	84.6	13	6.9	.5
E28	92.7	85.5	13	6.5	.4
E29	91.8	84.8	13	6.3	.4
E30	92.3	85.5	12	6.3	.4
E31	91.6	83.1	14	7.4	.5
E32	91.5	83.3	13	7.4	.5
E33	92.3	86.4	12	5.5	.3
E34	98.2	95.4	4	4.7	.5
AVERAGE	92.90	86.00	11.80	6.50	.4
N	9	9	9	9	9
STD.DEV.	2.07	3.68	2.99	.92	.07
90% C.I.	1.28	2.28	1.85	.57	.04

HELICOPTER: DAUPHIN TABLE B.6.1

TEST DATE: 6-6-83

OPERATION: 6 DEGREE ICAO APPROACH

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
F35	91.1	84.6	NA	NA	NA
F36	92.4	85.9	NA	NA	NA
F46	94.6	88.4	NA	NA	NA
F47	95.3	89.8	NA	NA	NA
F48	95	88.4	NA	NA	NA
F49	95.2	88.1	NA	NA	NA
F50	95.8	89.6	NA	NA	NA
F51	93.9	86	NA	NA	NA
AVERAGE	94.20	87.60			
N	8	8			
STD.DEV.	1.63	1.88			
90% C.I.	1.09	1.26			

HELICOPTER: DAUPHIN TABLE B.6.2

TEST DATE: 6-6-83

OPERATION: 6 DEGREE ICAO APPROACH

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
F35	93.7	87.2	10	6.5	.4
F36	90.5	82.9	13	6.8	.4
F46	93.2	85.7	10	7.5	.6
F47	94.3	87.4	10	6.9	.5
F48	94.3	96.5	12	7.2	.5
F49	94	86.1	13	7.1	.5
F50	94.4	86.6	12	7.2	.5
F51	94.8	89.1	9	6	.4
AVERAGE	93.70	86.40	11.10	6.90	.5
N	8	8	8	8	8
STD.DEV.	1.36	1.76	1.55	.48	.05
90% C.I.	0.91	1.18	1.04	.32	.03

HELICOPTER: DAUPHIN TABLE B.6.3

TEST DATE: 6-6-83

OPERATION: 6 DEGREE ICAO APPROACH

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
F35	95.7	91.2	6	5.8	.5
F36	90.5	82.6	11	7.6	.6
F46	91.1	83.5	NA	NA	NA
F47	92.6	84.7	13	7.1	.5
F48	93	84.9	13	7.3	.5
F49	92.9	85.1	13	7	.5
F50	92.5	84	13	7.6	.5
F51	92.8	86	11	6.5	.4
AVERAGE	92.60	85.30	11.40	7.00	.5
N	8	8	7	7	7
STD.DEV.	1.54	2.62	2.57	.65	.04
90% C.I.	1.03	1.76	1.89	.48	.03

HELICOPTER: DAUPHIN TABLE B.3.3

TEST DATE: 6-6-83

OPERATION: 500 FT FLYOVER(0.7*VH)/TARGET IAS=105 KTS

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
C15	85	76.8	14	7.2	.5
C16	85.1	77.3	13	7	.5
C17	NA	NA	13	NA	NA
C18	85.5	77.2	13	7.5	.5
C19	85.3	77.4	13	7.1	.5
C20	85.1	76.8	13	7.5	.5
AVERAGE	85.20	77.10	13.20	7.20	.5
N	5	5	6	5	5
STD.DEV.	0.20	0.28	0.41	.21	.03
90% C.I.	0.19	0.27	0.34	.2	.03

HELICOPTER: DAUPHIN TABLE B.4.1

TEST DATE: 6-6-83

OPERATION: 1000 FT FLYOVER(0.9*VH)/TARGET IAS=135 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
D21	82.4	73.3	NA	NA	NA
D22	82.2	73	NA	NA	NA
D23	82.7	74.1	NA	NA	NA
D24	82.4	72.9	NA	NA	NA
D25	82.6	73.3	NA	NA	NA
AVERAGE	82.50	73.30			
N	5	5			
STD.DEV.	0.19	0.47			
90% C.I.	0.19	0.45			

HELICOPTER: DAUPHIN TABLE B.3.1

TEST DATE: 6-6-83

OPERATION: 500 FT FLYOVER(0.7*VH)/TARGET IAS=105 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
C15	84.9	77.3	NA	NA	NA
C16	85.4	77.7	NA	NA	NA
C17	85.2	77.1	NA	NA	NA
C18	85.2	77.2	NA	NA	NA
C19	85.4	77.6	NA	NA	NA
C20	85.5	77.2	NA	NA	NA
AVERAGE	85.30	77.40			
N	6	6			
STD.DEV.	0.22	0.24			
90% C.I.	0.18	0.20			

HELICOPTER: DAUPHIN TABLE B.3.2

TEST DATE: 6-6-83

OPERATION: 500 FT FLYOVER(0.7*VH)/TARGET IAS=105 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
C15	85.2	76.9	13	7.5	.5
C16	85.7	77.8	12	7.3	.5
C17	85.5	77.5	12	7.4	.5
C18	85.3	77.1	13	7.4	.5
C19	85.7	77.7	12	7.4	.5
C20	85.6	77.6	12	7.4	.5
AVERAGE	85.50	77.40	12.30	7.40	.5
N	6	6	6	6	6
STD.DEV.	0.21	0.36	0.52	.05	.01
90% C.I.	0.17	0.29	0.42	.04	.01

HELICOPTER: DAUPHIN TABLE B.2.2

TEST DATE: 6-6-83

OPERATION: 500 FT FLYOVER(0.8*VH)/TARGET IAS=120 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
B11	85.9	78.1	11	7.5	.5
B12	86	NA	11	NA	NA
B13	85.6	78.3	11	7	.5
B14	88.8	78.6	10	10.2	1
AVERAGE	86.60	78.30	10.80	8.20	.7
N	4	3	4	3	3
STD.DEV.	1.49	0.25	0.50	1.72	.31
90% C.I.	1.76	0.42	0.59	2.9	.52

HELICOPTER: DAUPHIN TABLE B.2.3

TEST DATE: 6-6-83

OPERATION: 500 FT FLYOVER(0.8*VH)/TARGET IAS=120 KTS

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
B11	84.9	77.8	11	6.8	.5
B12	85.2	77.8	11	7.1	.5
B13	85	77.5	12	6.9	.5
B14	85.3	77.8	12	6.9	.5
AVERAGE	85.10	77.70	11.50	7.00	.5
N	4	4	4	4	4
STD.DEV.	0.18	0.15	0.58	.12	.02
90% C.I.	0.21	0.18	0.68	.14	.02

HELICOPTER: DAUPHIN TABLE B.1.3

TEST DATE: 6-6-83

OPERATION: 500 FT FLYOVER(0.9*VH)/TARGET IAS=135 KTS

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
A1	87.5	80.1	11	7.1	.5
A2	88	80.7	10	7.3	.5
A3	86.4	79.8	10	6.6	.5
A4	89	82.6	9	6.7	.5
A5	85.9	78.5	13	6.6	.4
A6	85.7	78.7	11	6.7	.5
A7	85.9	78.3	13	6.8	.4
A8	85.7	78.8	10	6.9	.5
A9	85.5	78.3	12	6.7	.4
A10	85.2	78.5	11	6.4	.4
AVERAGE	86.50	79.40	11.00	6.80	.5
N	10	10	10	10	10
STD.DEV.	1.26	1.39	1.33	.25	.04
90% C.I.	0.73	0.81	0.77	.15	.02

HELICOPTER: DAUPHIN TABLE B.2.1

TEST DATE: 6-6-83

OPERATION: 500 FT FLYOVER(0.8*VH)/TARGET IAS=120 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
B11	85.6	78.9	NA	NA	NA
B12	85.4	78.2	NA	NA	NA
B13	84.9	77.8	NA	NA	NA
B14	86	79.2	NA	NA	NA
AVERAGE	85.50	78.50			
N	4	4			
STD.DEV.	0.46	0.64			
90% C.I.	0.54	0.75			

HELICOPTER: DAUPHIN TABLE B.1.1

TEST DATE: 6-6-83

OPERATION: 500 FT FLYOVER(0.9*VH)/TARGET IAS=135 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
A1	87	78.3	NA	NA	NA
A2	88	79.1	NA	NA	NA
A3	NA	NA	NA	NA	NA
A4	90	80.7	NA	NA	NA
A5	85.7	76.8	NA	NA	NA
A6	86.4	76.6	NA	NA	NA
A7	86.4	75.1	NA	NA	NA
A8	85.9	76.4	NA	NA	NA
A9	86.5	75.2	NA	NA	NA
A10	85.5	76	NA	NA	NA
AVERAGE	86.80	77.10			
N	9	9			
STD.DEV.	1.41	1.87			
90% C.I.	0.87	1.16			

HELICOPTER: DAUPHIN TABLE B.1.2

TEST DATE: 6-6-83

OPERATION: 500 FT FLYOVER(0.9*VH)/TARGET IAS=135 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
A1	88.1	81.1	9	7.3	.6
A2	88.5	81.2	10	7.3	.5
A3	87.3	80.5	9	7.1	.5
A4	90.1	82.9	NA	NA	NA
A5	86.5	79.1	12	6.9	.5
A6	86.3	79	10	7.3	.5
A7	86.5	78.9	13	6.8	.4
A8	86.4	79.3	10	7.1	.5
A9	86.2	78.7	13	6.7	.4
A10	85.8	78.5	10	7.3	.5
AVERAGE	87.20	79.90	10.70	7.10	.5
N	10	10	9	9	9
STD.DEV.	1.35	1.44	1.58	.24	.05
90% C.I.	0.78	0.84	0.98	.15	.03

APPENDIX B

Direct Read Acoustical Data and Duration Factors for Flight Operations

In addition to the magnetic recording systems, four direct-read, Type-1 noise measurement systems were deployed at selected sites during flight operations. The data acquisition is described in Section 5.6.2.

These direct read systems collected single event data consisting of maximum A-weighted sound level (AL), Sound Exposure Level (SEL), integration time (T), and equivalent sound level (LEQ). The SEL and dBA, as well as the integration time were put into a computer data file and analyzed to determine two figures of merit related to the event duration influence on the SEL energy dose metric. The data reduction is further described in Section 6.2.2; the analysis of these data is discussed in Section 9.4.

This appendix presents direct read data and contains the results of the helicopter noise duration effect analysis for flight operations. The direct read acoustical data for static operations is presented in Appendix D.

Each table within this appendix provides the following information:

Run No.	The test run number
SEL(dB)	Sound Exposure Level, expressed in decibels
AL(dB)	A-Weighted Sound Level, expressed in decibels
T(10-dB)	Integration time
K(A)	Propagation constant describing the change in dBA with distance
Q	Time history "shape factor"
Average	The average of the column
N	Sample size
Std Dev	Standard Deviation
90% C.I.	Ninety percent confidence interval
Mic Site	The centerline mircophone site at which the measurements were taken

TABLE NO. A.1-5.3

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 5 CENTERLINE - 180 M. EAST JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
TAKEOFF -- TARGET IAS 75KTS. (T/O FROM HOVER)													
8A37	97.7	93.3	4.4	5.9	0.5	103.1	106.4	108.9	5.7	95.4	5.5	5.5	2.5
8A38	97.4	92.6	4.8	5.9	0.5	102.9	105.9	108.4	5.8	94.9	6.5	6.0	2.9
8A39	97.6	93.4	4.2	5.6	0.5	103.1	106.4	109.1	5.7	96.3	5.5	5.0	2.7
8A40	96.7	92.3	4.4	5.7	0.5	102.0	105.5	107.6	5.6	94.8	6.0	6.0	2.2
Avg.	97.4	92.9	4.4	5.8	0.5	102.8	106.1	108.5	5.7	95.4	5.9	5.6	2.6
Std Dv	0.4	0.5	0.2	0.2	0.0	0.5	0.5	0.7	0.1	0.7	0.5	0.5	0.3
90% CI	0.5	0.6	0.3	0.2	0.0	0.6	0.5	0.8	0.1	0.8	0.6	0.6	0.4
TAKEOFF -- TARGET IAS 75KTS. (T/O FROM GROUND)													
8B41	94.2	91.4	4.9	5.9	0.4	101.5	103.4	106.5	6.2	92.6	7.0	6.5	3.1
8B42	95.3	90.3	5.0	6.1	0.5	-	102.9	105.8	-	91.7	6.5	-	2.9
8B43	94.5	89.6	4.9	5.8	0.4	99.7	102.2	104.9	5.9	91.5	7.0	6.5	2.7
8B44	95.0	89.2	5.9	6.2	0.4	100.3	101.2	104.7	6.1	90.2	9.0	8.5	3.5
8B45	94.4	88.8	5.6	6.2	0.5	99.6	100.9	103.9	6.5	90.2	8.0	7.5	3.0
Avg.	95.1	89.9	5.2	6.0	0.4	100.3	102.1	105.2	6.2	91.2	7.5	7.2	3.0
Std Dv	0.7	1.0	0.5	0.2	0.0	0.9	1.1	1.0	0.3	1.0	1.0	1.0	0.3
90% CI	0.7	1.0	0.4	0.2	0.0	1.0	1.0	1.0	0.3	1.0	1.0	1.1	0.3
9 DEGREE APPROACH -- TARGET IAS 75KTS.													
M52	94.5	88.4	6.0	6.3	0.4	98.6	101.7	102.7	6.4	98.8	9.0	8.5	0.9
M53	96.0	90.4	5.5	6.5	0.5	99.4	102.9	103.6	6.3	98.4	7.0	8.0	0.8
M54	95.6	90.1	5.5	6.0	0.4	99.6	103.2	104.3	5.9	99.9	8.0	8.0	1.1
M55	95.6	90.6	5.0	5.9	0.5	98.7	102.5	103.1	6.3	99.3	7.0	8.0	0.6
M56	95.1	89.4	5.7	6.3	0.5	99.2	103.1	104.1	5.9	100.0	8.0	7.5	0.9
Avg.	95.3	89.8	5.5	6.2	0.5	99.1	102.7	103.6	6.2	99.3	7.8	8.0	0.9
Std Dv	0.6	0.9	0.4	0.2	0.0	0.4	0.6	0.7	0.3	0.7	0.8	0.4	0.2
90% CI	0.5	0.8	0.4	0.2	0.0	0.4	0.6	0.7	0.2	0.7	0.8	0.3	0.2

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-5.2

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 5 CENTERLINE - 188 M. EAST JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	DASPLm	DUR(A)	DUR(P)	TC
500 FT. FLYOVER -- TARGET IAS 135 KTS.													
A3	86.5	79.6	6.9	6.2	0.4	92.1	93.0	94.6	6.3	92.2	13.0	15.0	2.0
A4	89.0	82.3	6.7	7.0	0.5	94.2	95.8	96.9	7.7	88.6	9.0	9.0	1.5
A5	85.9	78.3	7.6	6.2	0.3	91.6	92.0	93.2	6.9	90.9	17.0	17.0	1.6
A6	85.6	78.6	7.0	6.8	0.5	91.1	92.4	93.7	6.9	89.4	10.5	11.5	1.5
A7	86.1	78.4	7.7	6.2	0.3	91.8	91.8	93.2	6.9	91.3	18.0	17.5	2.1
A8	84.8	77.9	6.9	6.7	0.4	90.2	91.6	92.5	7.0	89.4	11.0	12.5	1.1
A9	85.6	78.0	7.6	6.3	0.4	91.2	91.1	92.4	7.0	90.8	16.0	18.0	1.5
A10	84.6	77.6	7.0	6.8	0.5	90.1	91.0	92.1	7.2	87.5	11.0	13.0	1.7
Avg.	86.0	78.8	7.2	6.5	0.4	91.5	92.3	93.6	7.0	90.0	13.2	14.2	1.6
Std Dv	1.4	1.5	0.4	0.3	0.1	1.3	1.5	1.6	0.4	1.6	3.4	3.2	0.3
90% CI	0.9	1.0	0.3	0.2	0.0	0.9	1.0	1.0	0.3	1.0	2.3	2.2	0.2
500 FT. FLYOVER -- TARGET IAS 120 KTS.													
B11	84.8	77.5	7.3	7.0	0.5	89.3	91.2	92.5	6.5	87.7	11.0	11.5	1.5
B12	84.4	77.0	7.4	6.9	0.5	89.0	90.3	91.6	7.1	87.0	11.5	11.0	1.2
B13	84.2	76.8	7.4	6.9	0.5	88.7	89.9	90.9	7.1	86.6	12.0	12.5	1.2
B14	84.9	78.1	6.8	6.5	0.4	89.9	91.5	92.9	7.0	87.1	11.0	10.0	1.4
Avg.	84.6	77.4	7.2	6.8	0.5	89.2	90.7	92.0	6.9	87.1	11.4	11.2	1.3
Std Dv	0.3	0.6	0.3	0.2	0.0	0.5	0.7	0.9	0.3	0.5	0.5	1.0	0.2
90% CI	0.4	0.7	0.3	0.2	0.0	0.6	0.9	1.0	0.3	0.5	0.6	1.2	0.2
500 FT. FLYOVER -- TARGET IAS 105 KTS.													
C15	84.4	76.7	7.7	6.9	0.5	89.0	89.5	91.8	6.8	85.0	13.0	11.5	2.2
C16	84.5	77.0	7.5	6.9	0.5	88.7	90.0	90.9	7.1	86.6	12.5	12.5	0.9
C17	84.4	76.7	7.8	7.0	0.5	89.0	89.5	91.1	7.2	86.4	13.0	12.5	1.6
C18	84.4	76.7	7.7	6.9	0.5	88.6	89.7	90.7	7.2	87.0	13.0	12.5	1.2
C19	84.6	77.1	7.4	6.7	0.4	88.9	90.1	91.0	7.2	86.4	13.0	12.0	1.6
C20	84.3	76.4	7.9	7.1	0.5	88.6	89.5	90.7	7.3	85.2	13.0	12.5	1.3
Avg.	84.4	76.8	7.7	6.9	0.5	88.8	89.7	91.0	7.1	86.3	12.9	12.2	1.5
Std Dv	0.1	0.3	0.2	0.1	0.0	0.2	0.3	0.4	0.2	0.7	0.2	0.4	0.5
90% CI	0.1	0.2	0.1	0.1	0.0	0.1	0.2	0.3	0.2	0.6	0.2	0.3	0.4
1000 FT. FLYOVER -- TARGET IAS 135 KTS.													
D21	80.5	71.4	9.1	7.0	0.4	85.3	84.1	86.1	6.9	84.1	19.5	21.5	2.2
D22	80.1	71.3	8.8	7.0	0.4	84.7	83.9	85.1	7.1	83.4	18.0	23.0	1.2
D23	80.8	72.6	8.1	6.9	0.4	85.7	85.1	86.8	6.9	84.0	15.0	19.0	1.8
D24	80.4	70.8	9.6	7.4	0.5	85.1	83.8	84.9	7.4	82.5	19.5	24.0	1.4
D25	81.0	72.6	8.4	7.2	0.5	85.9	85.3	87.0	7.2	83.8	15.0	17.0	1.7
Avg.	80.6	71.8	8.8	7.1	0.4	85.4	84.5	86.0	7.1	83.6	17.4	20.9	1.7
Std Dv	0.3	0.8	0.6	0.2	0.0	0.5	0.7	1.0	0.2	0.6	2.3	2.9	0.4
90% CI	0.3	0.8	0.5	0.2	0.0	0.4	0.7	0.9	0.2	0.6	2.2	2.7	0.4

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-5.1

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 5 CENTERLINE - 188 M. EAST JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 75 KTS. (ICAO)													
F35	90.6	84.7	5.9	6.5	0.5	95.4	98.6	99.4	6.7	93.2	8.0	8.0	0.7
F36	92.3	86.1	6.2	6.2	0.4	96.4	99.6	100.6	6.1	96.3	10.0	9.0	1.0
F46	94.5	88.2	6.3	6.1	0.4	98.5	101.7	102.4	6.0	97.7	10.5	10.0	0.8
F47	95.1	89.3	5.8	6.1	0.4	98.4	100.6	102.2	6.5	96.2	9.0	9.0	1.6
F48	94.6	88.2	6.4	6.7	0.5	98.9	101.8	102.9	6.1	98.4	9.0	9.5	1.1
F49	95.0	88.0	7.0	7.0	0.5	99.1	101.9	102.8	6.6	98.2	10.0	9.0	1.1
F50	95.7	89.3	6.4	6.4	0.4	99.1	102.0	103.0	6.3	98.6	10.0	9.0	1.0
F51	94.0	86.2	7.8	7.1	0.5	98.3	100.0	101.2	6.6	96.2	12.5	12.0	1.2
Avg.	94.0	87.5	6.5	6.5	0.5	98.0	100.8	101.8	6.4	96.8	9.9	9.4	1.1
Std Dv	1.7	1.7	0.6	0.4	0.0	1.4	1.3	1.3	0.3	1.8	1.3	1.2	0.3
90% CI	1.1	1.1	0.4	0.3	0.0	0.9	0.8	0.9	0.2	1.2	0.9	0.8	0.2
TAKEOFF — TARGET IAS 75 KTS. (ICAO)													
E26	95.3	89.3	5.9	6.2	0.4	100.4	101.1	104.8	6.0	89.9	9.0	8.5	3.7
E27	94.4	88.4	6.0	6.2	0.4	100.0	100.9	104.2	6.0	89.2	9.5	9.0	3.3
E28	94.5	88.6	5.9	6.0	0.4	99.8	101.2	104.5	6.1	89.5	9.5	7.5	3.4
E29	94.1	87.9	6.2	6.3	0.4	99.6	99.8	103.3	6.3	88.8	9.5	10.0	3.5
E30	94.9	89.1	5.8	5.9	0.4	100.6	101.4	104.9	5.9	89.8	9.5	9.0	3.5
E31	94.3	88.0	6.2	6.1	0.4	99.9	100.2	103.8	6.2	88.7	10.5	9.5	3.6
E32			----------	NO DATA		----------							
E33	94.9	89.1	5.8	6.0	0.4	100.4	101.7	104.9	6.0	90.1	9.0	8.5	3.2
Avg.	94.6	88.6	6.0	6.1	0.4	100.1	100.9	104.3	6.1	89.4	9.5	8.9	3.5
Std Dv	0.4	0.6	0.2	0.1	0.0	0.4	0.7	0.6	0.1	0.5	0.5	0.8	0.2
90% CI	0.3	0.4	0.1	0.1	0.0	0.3	0.5	0.4	0.1	0.4	0.4	0.6	0.1

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-4.3

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 4 CENTERLINE - 150 M. WEST JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
TAKEOFF -- TARGET IAS 75 KTS. (T/O FROM HOVER)													
GA37	92.9	87.1	5.8	6.2	0.4	97.9	100.0	102.5	6.0	89.0	8.5	8.0	2.5
GA38	93.3	88.0	5.3	5.9	0.4	98.3	100.5	103.4	5.8	89.1	8.0	7.0	2.9
GA39	92.5	86.4	6.1	6.4	0.4	97.7	99.8	101.9	6.1	89.1	9.0	9.0	2.0
GA40	91.9	85.5	6.4	6.5	0.5	97.1	98.6	101.1	6.2	87.2	9.5	9.5	2.5
Avg.	92.6	86.8	5.9	6.2	0.4	97.8	99.7	102.2	6.0	88.6	8.7	8.4	2.5
Std Dv	0.6	1.0	0.4	0.3	0.0	0.5	0.8	1.0	0.2	1.0	0.6	1.1	0.4
90% CI	0.7	1.2	0.5	0.3	0.0	0.6	1.0	1.2	0.2	1.1	0.8	1.3	0.5
TAKEOFF -- TARGET IAS 75 KTS. (T/O FROM GROUND)													
GB41	91.1	83.7	7.4	6.7	0.4	95.8	95.6	98.8	6.7	84.6	13.0	11.0	3.5
GB42	91.5	84.3	7.2	6.6	0.4	96.2	96.1	99.4	6.4	85.1	12.5	11.5	3.4
GB43	90.4	83.1	7.3	6.5	0.4	95.2	94.9	98.4	6.6	84.4	13.0	10.5	3.5
GB44	90.3	82.3	8.0	6.9	0.4	94.7	94.2	97.2	7.1	83.3	14.5	11.0	3.0
GB45	90.1	82.4	7.8	6.5	0.4	94.5	93.6	97.0	6.9	83.3	15.5	12.5	3.5
Avg.	90.7	83.1	7.5	6.6	0.4	95.3	94.9	98.2	6.7	84.1	13.7	11.3	3.4
Std Dv	0.6	0.9	0.4	0.2	0.0	0.7	1.0	1.0	0.3	0.8	1.3	0.8	0.2
90% CI	0.6	0.8	0.3	0.2	0.0	0.7	1.0	1.0	0.3	0.7	1.2	0.7	0.2
9 DEGREE APPROACH -- TARGET IAS 75 KTS.													
H52	93.1	84.8	8.3	7.5	0.5	96.5	98.1	99.1	6.9	95.0	12.5	12.0	1.0
H53	89.0	79.6	9.4	7.7	0.5	92.4	92.1	93.0	7.8	93.2	16.5	16.0	0.9
H54	89.3	80.3	9.0	7.6	0.5	92.6	93.1	94.1	7.3	92.8	15.5	15.0	0.9
H55	91.3	83.3	8.0	6.9	0.4	95.2	97.0	98.2	6.6	93.7	14.5	12.0	1.1
H56	90.0	80.9	9.2	7.3	0.5	93.9	94.6	95.7	7.1	91.9	18.0	14.0	1.1
Avg.	90.5	81.8	8.8	7.4	0.5	94.1	95.0	96.0	7.1	93.3	15.4	13.8	1.0
Std Dv	1.7	2.2	0.6	0.3	0.0	1.8	2.5	2.6	0.5	1.1	2.1	1.8	0.1
90% CI	1.6	2.1	0.6	0.3	0.0	1.7	2.4	2.5	0.4	1.1	2.0	1.7	0.1

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-4.2

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 4 CENTERLINE - 150 M. WEST JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
500 FT. FLYOVER -- TARGET IAS 135 KTS.													
A3	85.2	78.5	6.7	6.5	0.4	90.2	91.9	93.5	6.3	90.7	10.5	11.5	1.7
A4	87.7	80.9	6.8	6.9	0.5	92.9	94.5	96.2	7.0	89.0	9.5	9.0	2.1
A5	84.9	77.5	7.4	6.6	0.4	90.1	90.9	92.7	6.6	90.5	13.0	13.5	2.0
A6	84.5	77.4	7.2	7.0	0.5	89.6	91.1	92.3	7.0	88.4	10.5	11.0	1.6
A7	84.6	77.1	7.5	6.6	0.4	90.0	90.5	91.7	7.0	89.7	13.5	15.0	1.4
A8	84.4	76.9	7.5	7.1	0.5	89.6	90.6	92.2	6.9	88.4	11.5	12.0	1.8
A9	84.3	77.1	7.2	6.7	0.4	89.4	90.4	91.7	6.9	89.5	12.0	13.5	1.7
A10	84.0	76.7	7.3	7.0	0.5	89.3	90.2	91.4	7.3	87.7	11.0	12.0	1.3
Avg.	84.9	77.8	7.2	6.8	0.5	90.1	91.3	92.7	6.9	89.2	11.4	12.2	1.7
Std Dv	1.2	1.4	0.3	0.2	0.0	1.2	1.4	1.6	0.3	1.1	1.3	1.8	0.3
90% CI	0.8	0.9	0.2	0.1	0.0	0.8	0.9	1.0	0.2	0.7	0.9	1.2	0.2
500 FT. FLYOVER -- TARGET IAS 120 KTS.													
B11	83.5	76.4	7.1	6.8	0.5	87.6	89.7	90.7	6.6	86.2	11.0	11.0	1.0
B12	83.7	76.4	7.3	7.0	0.5	88.4	89.6	91.1	7.1	86.3	11.0	11.0	1.1
B13	83.5	76.4	7.1	6.8	0.5	87.6	89.4	90.7	6.7	86.0	11.0	10.5	1.4
B14	83.7	76.7	7.1	6.9	0.5	88.5	90.0	91.2	7.1	85.5	10.5	10.5	1.6
Avg.	83.6	76.5	7.1	6.9	0.5	88.0	89.7	90.9	6.9	86.0	10.9	10.7	1.3
Std Dv	0.1	0.1	0.1	0.1	0.0	0.5	0.3	0.3	0.3	0.3	0.2	0.3	0.2
90% CI	0.2	0.2	0.1	0.1	0.0	0.6	0.3	0.3	0.3	0.4	0.3	0.3	0.3
500 FT. FLYOVER -- TARGET IAS 105 KTS.													
C15	83.6	75.5	8.0	7.0	0.5	87.9	88.7	90.3	7.0	84.1	14.0	12.0	1.6
C16	83.7	75.9	7.8	7.1	0.5	87.8	88.8	89.7	7.4	86.0	12.5	12.5	0.9
C17	83.4	75.7	7.7	6.9	0.5	87.7	88.7	89.9	7.2	85.1	13.0	12.0	1.2
C18	83.6	75.4	8.2	7.1	0.5	87.5	88.0	89.4	7.3	86.1	14.0	12.5	1.5
C19	83.7	76.3	7.4	6.9	0.5	88.0	89.2	90.4	7.0	86.0	12.0	12.0	1.1
C20	83.7	76.1	7.7	7.0	0.5	87.9	89.0	90.4	6.8	86.4	12.5	12.5	1.4
Avg.	83.6	75.8	7.8	7.0	0.5	87.8	88.7	90.0	7.1	85.6	13.0	12.2	1.3
Std Dv	0.1	0.3	0.3	0.1	0.0	0.2	0.4	0.4	0.2	0.9	0.8	0.3	0.2
90% CI	0.1	0.3	0.2	0.1	0.0	0.1	0.3	0.3	0.2	0.7	0.7	0.2	0.2
1000 FT. FLYOVER -- TARGET IAS 135 KTS.													
D21	80.1	71.1	9.0	7.2	0.4	84.6	83.8	85.5	7.3	82.9	18.0	18.0	2.3
D22	79.6	69.9	9.8	7.5	0.5	83.9	82.8	83.9	7.4	83.2	20.0	22.0	1.5
D23	79.8	72.0	7.8	6.6	0.4	84.3	84.1	86.3	6.6	82.7	15.0	16.5	2.2
D24	80.0	69.8	10.2	7.8	0.5	84.6	83.1	85.1	7.3	82.7	20.5	20.0	2.3
D25	80.3	72.5	7.8	6.7	0.4	84.8	84.1	86.4	7.1	82.7	14.5	15.5	2.7
Avg.	80.0	71.1	8.9	7.1	0.4	84.4	83.6	85.4	7.1	82.9	17.6	18.4	2.2
Std Dv	0.3	1.2	1.1	0.5	0.0	0.4	0.6	1.0	0.4	0.2	2.8	2.6	0.4
90% CI	0.3	1.2	1.1	0.5	0.0	0.4	0.6	1.0	0.3	0.2	2.6	2.5	0.4

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPEPATURE,HUMIDITY,OR AIRCKAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-4.1

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 4 CENTERLINE - 150 M. WEST JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 75 KTS. (ICAO)													
F35	92.3	87.1	5.2	5.7	0.4	95.6	98.9	99.8	6.3	95.4	8.0	8.5	0.9
F36	88.8	80.7	8.1	7.5	0.5	92.6	93.8	95.0	7.1	92.4	12.0	12.0	1.2
F46	90.8	83.1	7.6	6.9	0.4	94.8	96.5	97.8	6.6	92.7	13.0	11.5	1.3
F47	92.1	84.1	8.0	6.9	0.4	95.8	97.5	98.8	6.5	93.9	14.0	12.0	1.3
F48	92.4	84.2	8.2	7.2	0.5	96.2	97.7	99.0	6.7	94.1	14.0	12.0	1.3
F49	92.7	84.7	8.1	7.0	0.5	96.5	98.3	99.4	6.5	94.7	14.0	12.5	1.2
F50	92.5	84.1	8.4	6.7	0.4	96.0	96.7	97.8	7.4	93.6	17.5	13.0	1.1
F51	92.8	85.9	6.8	6.5	0.4	96.3	98.5	99.8	6.3	95.4	11.5	11.0	1.3
Avg.	91.8	84.3	7.5	6.8	0.4	95.5	97.2	98.4	6.7	94.0	13.0	11.6	1.2
Std Dv	1.4	1.9	1.1	0.5	0.0	1.3	1.6	1.6	0.4	1.1	2.7	1.4	0.1
90% CI	0.9	1.3	0.7	0.4	0.0	0.9	1.1	1.1	0.3	0.8	1.8	0.9	0.1
TAKEOFF -- TARGET IAS 75 KTS. (ICAO)													
E26	92.4	85.1	7.3	7.0	0.5	97.0	97.0	99.9	6.9	86.9	11.0	10.5	2.9
E27	91.6	83.5	8.1	7.0	0.4	96.4	95.9	99.3	6.9	84.0	14.5	11.0	3.6
E28	91.8	84.0	7.8	6.8	0.4	97.0	96.9	99.6	6.7	84.1	14.0	13.0	3.0
E29	90.9	82.9	7.9	6.8	0.4	95.8	95.1	98.3	6.6	83.6	14.5	13.5	3.1
E30	91.5	84.2	7.2	6.7	0.4	96.5	96.6	99.7	6.5	84.7	12.0	11.0	3.1
E31	91.0	82.3	8.7	7.6	0.5	95.9	94.7	97.7	7.3	83.0	14.0	13.5	2.9
E32	91.0	83.0	8.0	7.2	0.5	95.9	94.7	97.9	7.1	83.4	13.0	13.0	3.4
E33	91.3	84.3	7.0	6.3	0.4	96.2	96.6	99.7	5.9	84.9	13.0	12.5	3.4
Avg.	91.4	83.7	7.8	6.9	0.5	96.3	95.9	99.0	6.7	84.3	13.2	12.2	3.2
Std Dv	0.5	0.9	0.6	0.4	0.0	0.5	1.0	0.9	0.4	1.2	1.3	1.2	0.3
90% CI	0.7	0.6	0.4	0.3	0.0	0.3	0.6	0.6	0.3	0.8	0.8	0.8	0.2

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-3.3

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 3 SIDELINE - 150 M. NORTH JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
TAKEOFF -- TARGET IAS 75 KTS. (T/O FROM HOVER)													
0A37	84.0	76.6	7.3	6.7	0.4	88.1	89.2	91.1	6.3	86.7	12.5	12.5	2.0
0A38	83.5	75.2	8.3	7.1	0.5	87.5	88.4	89.3	7.1	86.5	14.5	14.5	0.9
0A39	83.2	76.1	7.1	6.9	0.5	87.4	88.3	90.6	6.8	86.4	10.5	10.0	2.7
0A40	83.8	76.7	7.1	6.5	0.4	88.1	89.4	91.8	5.9	86.3	12.5	12.0	2.4
Avg.	83.6	76.2	7.5	6.8	0.4	87.8	88.8	90.7	6.5	86.4	12.5	12.2	2.0
Std Dv	0.3	0.7	0.6	0.3	0.0	0.4	0.6	1.1	0.5	0.2	1.6	1.8	0.8
90% CI	0.4	0.8	0.7	0.3	0.0	0.5	0.6	1.3	0.6	0.2	1.9	2.2	0.9
TAKEOFF -- TARGET IAS 75 KTS. (T/O FROM GROUND)													
0B41	85.6	78.3	7.3	6.7	0.4	89.8	89.5	92.4	6.7	87.7	12.5	12.5	3.0
0B42	84.9	77.2	7.7	6.6	0.4	89.1	89.0	91.6	6.7	88.6	14.5	13.0	3.1
0B43	85.9	77.9	8.0	6.4	0.3	90.3	89.3	93.0	6.0	87.6	18.0	17.0	3.7
0B44	85.7	78.1	7.7	6.6	0.4	89.8	89.4	92.5	6.3	87.9	14.5	14.0	3.9
0B45	85.8	78.3	7.4	6.4	0.4	89.9	89.6	93.4	5.9	88.5	14.5	13.0	3.8
Avg.	85.6	78.0	7.6	6.5	0.4	89.8	89.4	92.6	6.3	88.1	14.8	13.9	3.5
Std Dv	0.4	0.4	0.3	0.1	0.0	0.4	0.2	0.7	0.4	0.4	2.0	1.8	0.4
90% CI	0.4	0.4	0.2	0.1	0.0	0.4	0.2	0.6	0.4	0.4	1.9	1.7	0.4
9 DEGREE APPROACH -- TARGET IAS 75 KTS.													
0N52	92.4	83.6	8.8	7.6	0.5	95.9	96.9	97.9	7.2	94.0	14.5	13.0	1.4
0N53	90.1	81.2	8.9	7.2	0.4	93.5	93.6	94.8	7.1	92.6	17.5	16.5	1.2
0N54	90.6	82.8	7.8	6.9	0.4	94.2	95.2	96.4	7.3	92.6	13.5	12.0	1.2
0N55	91.7	83.7	8.0	7.1	0.5	95.5	96.4	97.9	7.1	94.1	13.5	11.5	1.6
0N56	91.9	83.8	8.1	6.8	0.4	95.6	96.4	98.1	7.1	93.8	15.5	11.0	1.9
Avg.	91.3	83.0	8.3	7.1	0.5	94.9	95.7	97.0	7.2	93.4	14.9	12.8	1.4
Std Dv	1.0	1.1	0.5	0.3	0.0	1.0	1.3	1.4	0.1	0.8	1.7	2.2	0.3
90% CI	0.9	1.0	0.5	0.3	0.0	1.0	1.2	1.4	0.1	0.7	1.6	2.1	0.3

* -- NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-3.2

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 3 SIDELINE - 150 M. NORTH JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
500 FT. FLYOVER -- TARGET IAS 135 KTS.													
A3	85.4	78.3	7.0	6.5	0.4	90.6	91.6	92.9	6.9	93.3	12.0	13.0	1.3
A4	85.5	78.8	6.7	6.8	0.5	91.0	92.1	94.1	7.0	91.5	9.5	9.5	2.2
A5	85.4	78.2	7.2	6.6	0.4	90.5	91.6	92.9	6.8	93.6	12.0	13.0	1.3
A6	83.4	76.2	7.2	6.9	0.5	88.7	89.9	91.6	7.0	89.7	11.0	10.5	1.8
A7	85.6	78.7	6.9	6.6	0.4	90.7	92.2	93.3	6.8	93.6	11.0	12.0	1.5
A8	83.3	76.3	7.0	6.7	0.5	88.6	89.8	91.7	6.5	89.7	11.0	11.5	2.1
A9	85.4	78.5	6.9	6.5	0.4	90.6	91.9	93.0	6.8	93.1	11.5	13.0	1.2
A10	83.3	76.1	7.2	6.8	0.5	88.5	89.7	91.6	6.6	88.8	11.5	11.0	1.8
Avg.	84.7	77.6	7.0	6.7	0.5	89.9	91.1	92.6	6.8	91.7	11.2	11.7	1.7
Std Dv	1.1	1.2	0.2	0.1	0.0	1.1	1.1	0.9	0.2	2.0	0.8	1.3	0.4
90% CI	0.7	0.8	0.1	0.1	0.0	0.7	0.7	0.6	0.1	1.4	0.5	0.9	0.3
500 F . FLYOVER -- TARGET IAS 120 KTS.													
B11	83.8	76.0	7.8	6.9	0.4	88.4	89.1	90.0	7.2	89.6	13.5	14.5	0.9
B12	83.0	75.3	7.7	6.8	0.4	87.9	88.5	89.6	7.3	86.0	13.5	13.5	1.4
B13	84.0	76.3	7.8	6.9	0.4	88.7	89.4	90.3	7.3	89.6	13.5	14.5	0.9
B14	83.3	76.1	7.2	6.7	0.4	88.2	89.0	90.8	7.0	86.6	12.0	11.5	2.0
Avg.	83.5	75.9	7.6	6.8	0.4	88.3	89.0	90.2	7.2	88.0	13.1	13.5	1.3
Std Dv	0.5	0.4	0.3	0.1	0.0	0.3	0.4	0.5	0.2	1.9	0.7	1.4	0.5
90% CI	0.5	0.5	0.3	0.1	0.0	0.4	0.4	0.6	0.2	2.2	0.9	1.7	0.6
500 FT. FLYOVER -- TARGET IAS 105 KTS.													
C15	83.8	75.9	7.9	6.8	0.4	88.5	88.7	90.3	7.0	88.9	14.5	15.0	1.6
C16	82.9	74.4	8.5	6.8	0.4	87.4	87.4	88.4	7.3	82.1	18.0	16.5	0.9
C17	84.1	76.4	7.7	6.9	0.5	88.6	89.3	89.9	7.1	89.4	13.0	17.0	0.6
C18	83.7	76.8	6.9	6.0	0.3	88.4	88.2	91.4	6.2	83.9	14.0	13.5	3.2
C19	84.1	76.4	7.7	6.9	0.5	88.7	89.4	90.2	7.2	89.1	13.0	15.5	0.8
C20	83.7	75.3	8.4	6.7	0.4	88.1	88.4	89.5	7.2	84.2	17.5	15.5	1.1
Avg.	83.7	75.9	7.8	6.7	0.4	88.3	88.6	89.9	7.0	86.3	15.0	15.5	1.4
Std Dv	0.4	0.9	0.6	0.4	0.0	0.5	0.7	1.0	0.4	3.2	2.2	1.2	1.0
90% CI	0.4	0.7	0.5	0.3	0.0	0.4	0.6	0.8	0.3	2.6	1.8	1.0	0.8
1000 FT. FLYOVER -- TARGET IAS 135 KTS.													
D21	81.5	73.5	8.1	7.0	0.5	85.2	85.1	86.8	6.7	86.7	14.0	17.5	2.1
D22	81.0	74.0	7.1	6.2	0.4	85.1	84.5	86.7	6.8	86.6	13.5	17.0	2.3
D23	81.6	73.0	8.7	7.2	0.5	85.8	84.9	86.8	7.1	87.3	16.0	18.5	1.9
D24	80.9	72.2	8.8	7.1	0.4	85.5	84.1	85.5	7.5	86.9	17.0	22.0	1.7
D25	80.6	71.0	9.6	7.3	0.4	85.2	83.8	85.7	7.2	86.0	20.5	21.0	2.1
Avg.	81.1	72.7	8.4	7.0	0.4	85.4	84.5	86.3	7.1	86.7	16.2	19.2	2.0
Std Dv	0.4	1.2	1.0	0.4	0.0	0.3	0.5	0.6	0.3	0.5	2.8	2.2	0.2
90% CI	0.4	1.1	0.9	0.4	0.0	0.3	0.5	0.6	0.3	0.5	2.7	2.1	0.2

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-3.1

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 3 SIDELINE - 150 M. NORTH JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 75 KTS. (ICAO)													
F35	88.2	78.9	9.4	7.5	0.5	91.7	92.0	93.3	7.0	92.4	18.0	16.0	1.3
F36	92.4	85.2	7.2	7.1	0.5	96.2	97.9	99.0	7.2	96.0	10.5	10.0	1.1
F46	93.5	85.1	8.4	7.1	0.5	97.1	97.4	99.1	6.9	93.7	15.0	14.5	1.7
F47	92.8	84.6	8.2	7.0	0.5	96.1	96.5	98.0	7.1	92.7	14.5	14.0	1.4
F48	92.3	83.5	8.9	7.5	0.5	95.8	96.1	97.0	7.5	92.7	15.5	15.0	0.9
F49	92.7	83.9	8.8	7.1	0.4	96.2	96.2	98.3	6.9	92.1	17.0	14.0	2.1
F50	91.2	82.2	8.9	6.9	0.4	94.4	95.2	96.1	7.0	91.6	19.5	15.5	1.0
F51	91.2	82.5	8.7	7.1	0.4	95.2	94.9	97.0	7.0	71.4	17.0	15.0	2.0
Avg.	91.8	83.2	8.5	7.2	0.5	95.3	95.8	97.2	7.1	92.8	15.9	14.2	1.4
Std Dv	1.7	2.1	0.6	0.2	0.0	1.7	1.8	1.9	0.2	1.5	2.7	1.9	0.5
90% CI	1.1	1.4	0.4	0.1	0.0	1.1	1.2	1.3	0.1	1.0	1.8	1.2	0.3
TAKEOFF -- TARGET IAS 75 KTS. (ICAO)													
E26	85.8	77.8	8.0	6.6	0.4	89.6	89.6	91.6	6.6	88.6	16.0	16.0	2.1
E27	83.7	74.5	9.2	7.2	0.4	88.0	87.2	89.0	6.8	88.2	18.5	21.0	1.8
E28	84.2	76.0	8.1	6 7	0.4	88.5	88.1	90.7	6.5	87.7	15.0	15.5	2.6
E29	84.2	75.5	8.6	7.0	0.4	88.5	87.9	90.0	6.8	88.1	17.0	17.5	2.2
E30	83.8	75.2	8.6	7.3	0.5	88.3	87.7	89.9	6.8	87.9	15.0	16.5	3.1
E31	84.4	75.2	9.2	7.5	0.5	88.3	87.6	89.5	7.3	88.1	16.5	16.0	2.0
E32	84.3	77.0	7.4	6.4	0.4	88.6	88.7	91.1	6.3	88.7	14.0	15.5	2.6
E33	84.6	77.1	7.5	6.7	0.4	88.8	89.8	91.1	6.7	89.4	13.0	14.0	2.1
Avg.	84.4	76.1	8.3	7.0	0.4	88.6	88.3	90.4	6.7	88.3	15.6	16.5	2.3
Std Dv	0.6	1.1	0.7	0.4	0.0	0.5	1.0	0.9	0.3	0.5	1.7	2.1	0.4
90% CI	0.4	0.8	6.5	0.2	0.0	0.3	0.6	0.6	0.2	0.4	1.2	1.4	0.3

* = NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-2.3

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 2 SIDELINE - 150 M. SOUTH JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC

TAKEOFF -- TARGET IAS 75 KTS. (T/O FROM HOVER)

NO DATA

TAKEOFF -- TARGET IAS 75 KTS. (T/O FROM GROUND)

NO DATA

9 DEGREE APPROACH -- TARGET IAS 75 KTS.

NO DATA

TABLE NO. A.1-2.2

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/13/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 2 SIDELINE - 150 M. SOUTH JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
500 FT. FLYOVER -- TARGET IAS 135 KTS.													
A3	85.4	78.9	6.5	6.6	0.5	91.3	92.6	94.4	6.6	91.6	9.5	11.0	2.1
A4	88.6	81.1	7.5	7.4	0.5	93.7	94.7	96.1	7.3	96.4	10.5	11.0	1.6
A5	84.5	77.2	7.2	7.0	0.5	90.3	90.7	92.7	6.7	91.6	11.0	13.5	1.9
A6	86.2	79.1	7.1	6.8	0.5	90.9	91.9	93.1	7.2	94.6	11.0	12.0	1.2
A7	84.8	77.2	7.6	6.8	0.4	-	90.8	92.3	-	91.5	13.5	-	1.5
A8	86.3	79.4	6.9	6.6	0.4	91.2	92.2	93.4	7.1	95.0	11.0	12.5	1.1
A9	84.6	76.9	7.6	7.0	0.5	-	90.7	92.2	-	91.0	12.5	-	1.5
A10	86.1	79.0	7.1	6.8	0.5	91.2	92.4	93.7	7.0	94.4	11.0	12.0	1.3
Avg.	85.8	78.6	7.2	6.9	0.5	91.4	92.0	93.5	7.0	93.3	11.2	12.0	1.5
Std Dv	1.4	1.4	0.4	0.2	0.0	1.2	1.3	1.3	0.3	2.1	1.2	0.9	0.4
90% CI	0.9	0.9	0.3	0.2	0.0	1.0	0.9	0.9	0.2	1.4	0.8	0.8	0.2
500 FT. FLYOVER -- TARGET IAS 120 KTS.													
B11	83.8	76.7	7.2	6.8	0.5	89.0	89.5	91.3	7.1	87.1	11.5	12.0	1.7
B12	84.8	77.0	7.8	7.0	0.5	89.1	89.9	91.0	7.3	91.7	13.0	13.0	1.2
B13	83.6	75.6	8.1	7.1	0.5	88.8	88.7	90.1	7.5	86.7	13.5	14.0	1.3
B14	85.5	77.7	7.8	7.1	0.5	90.5	91.1	92.3	7.4	92.6	12.5	12.5	1.1
Avg.	84.4	76.7	7.7	7.0	0.5	89.3	89.8	91.2	7.4	89.5	12.6	12.9	1.3
Std Dv	0.9	0.9	0.4	0.2	0.0	0.8	1.0	0.9	0.2	3.1	0.9	0.9	0.3
90% CI	1.0	1.1	0.4	0.2	0.0	0.9	1.2	1.1	0.2	3.6	1.0	1.0	0.3
500 FT. FLYOVER -- TARGET IAS 105 KTS													
C15	82.6	73.5	9.1	7.6	0.5	87.1	86.7	88.1	7.8	84.9	16.0	14.5	1.5
C16	84.9	76.5	8.4	7.1	0.5	89.1	89.4	90.7	7.2	90.4	15.0	14.5	1.4
C17	83.0	74.3	8.8	7.4	0.5	87.9	87.1	88.7	3.0	85.2	15.0	14.5	1.6
C18	84.2	75.3	8.8	7.3	0.5	88.5	88.3	89.3	7.6	90.2	16.0	16.5	1.1
C19	83.0	74.3	8.7	7.5	0.5	87.8	87.5	88.6	7.7	85.3	14.5	15.5	1.1
C20	84.2	75.6	8.6	7.3	0.5	88.4	88.5	89.8	7.2	90.3	15.0	15.5	1.2
Avg.	83.6	74.9	8.7	7.4	0.5	88.2	87.9	89.2	7.6	87.7	15.2	15.2	1.3
Std Dv	0.9	1.1	0.2	0.1	0.0	0.7	1.0	0.9	0.3	2.8	0.6	0.8	0.2
90% CI	0.7	0.9	0.2	0.1	0.0	0.6	0.8	0.8	0.2	2.3	0.5	0.7	0.2
1000 FT. FLYOVER -- TARGET IAS 135 KTS.													
D21	80.3	72.2	8.2	6.9	0.4	84.9	83.7	85.4	7.2	85.9	15.0	21.5	2.8
D22	81.2	73.1	8.2	6.8	0.4	85.6	85.0	86.5	6.5	88.0	15.5	24.5	1.6
D23	80.1	71.8	8.3	7.0	0.4	84.8	83.4	85.1	7.5	86.3	15.5	20.0	2.7
D24	80.8	72.5	8.3	6.9	0.4	85.1	84.8	86.3	6.7	88.1	16.0	20.5	1.5
D25	79.2	70.2	9.1	7.1	0.4	-	82.3	83.9	-	86.2	19.0	-	2.5
Avg.	80.3	71.9	8.4	7.0	0.4	85.1	83.9	85.4	7.0	86.9	16.2	21.6	2.2
Std Dv	0.8	1.1	0.4	0.1	0.0	0.3	1.1	1.0	0.4	1.1	1.6	2.0	0.6
90% CI	0.7	1.0	0.4	0.1	0.0	0.4	1.1	1.0	0.5	1.0	1.5	2.4	0.6

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-2.1

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 2 SIDELINE - 150 M. SOUTH JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 75KTS. (ICAO)													
NO DATA													
TAKEOFF -- TARGET IAS 75KTS. (ICAO)													
E26	90.6	81.8	8.8	7.1	0.4	95.5	93.8	96.1	7.5	94.0	17.5	18.0	2.6
E27	89.0	79.9	9.0	7.4	0.5	93.9	92.6	94.3	7.6	93.4	16.5	18.5	2.3
E28	89.6	79.8	9.8	7.6	0.5	94.5	92.6	94.6	7.7	93.6	19.3	19.0	2.4
E29	89.5	80.1	9.4	7.4	0.5	94.5	92.8	94.9	7.6	93.6	19.0	18.5	2.5
E30	89.9	80.2	9.7	7.6	0.5	94.9	92.7	94.7	7.9	93.7	19.0	19.0	2.6
E31	89.9	79.7	10.2	8.0	0.6	-	93.0	96.0	-	93.4	19.0	-	3.0
E32	90.1	80.5	9.6	7.8	0.5	95.0	93.5	95.1	8.0	93.9	17.0	17.0	2.4
E33	90.8	81.4	9.4	7.6	0.5	96.0	94.4	97.0	7.3	94.3	17.5	17.0	3.1
Avg.	89.9	80.4	9.5	7.5	0.5	94.9	93.2	95.3	7.7	93.7	18.1	18.1	2.6
Std Dv	0.6	0.8	0.4	0.3	0.0	0.7	0.6	0.9	0.3	0.3	1.1	0.9	0.3
90% CI	0.4	0.5	0.3	0.2	0.0	0.5	0.4	0.6	0.2	0.2	0.8	0.6	0.2

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-16.3

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 16 CENTERLINE-CENTER (FLUSH) JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
TAKEOFF -- TARGET IAS 75KTS. (T/O FROM HOVER)													
GA37	99.5	93.8	5.7	6.3	0.5	105.0	106.8	109.1	6.5	96.2	8.0	8.0	2.4
GA38	99.9	94.2	5.7	6.1	0.4	105.3	107.2	109.5	6.1	96.6	8.5	9.0	2.8
GA39	99.9	94.9	5.0	5.8	0.4	105.3	107.9	110.4	5.8	97.4	7.5	7.0	2.6
GA40	99.8	93.8	6.1	6.5	0.5	105.3	107.3	109.4	6.4	98.2	8.5	8.5	2.1
Avg.	99.8	94.2	5.6	6.2	0.5	105.2	107.3	109.6	6.2	97.1	8.1	8.1	2.5
Std Dv	0.2	0.5	0.4	0.3	0.0	0.2	0.4	0.6	0.3	0.9	0.5	0.9	0.3
90% CI	0.2	0.6	0.5	0.4	0.0	0.2	0.5	0.7	0.4	1.0	0.6	1.0	0.3
TAKEOFF -- TARGET IAS 75KTS. (T/O FROM GROUND)													
GB41	97.5	90.3	7.1	6.4	0.4	102.5	102.7	105.8	6.7	91.2	13.0	10.0	3.3
GB42	96.8	89.7	7.1	6.5	0.4	101.8	102.1	104.7	6.8	91.6	12.0	11.0	2.8
GB43	96.7	88.5	8.2	7.1	0.5	101.9	100.8	103.7	7.1	90.2	14.5	14.0	3.4
GB44	96.1	88.2	7.9	7.0	0.5	101.0	100.0	103.2	6.9	89.6	13.5	13.5	3.2
GB45	96.0	87.4	8.5	7.4	0.5	101.2	99.9	102.7	7.3	89.1	14.5	14.5	2.8
Avg.	96.6	88.8	7.8	6.9	0.4	101.7	101.1	104.0	7.0	90.3	13.5	12.6	3.1
Std Dv	0.6	1.2	0.7	0.4	0.0	0.6	1.3	1.2	0.3	1.1	1.1	2.0	0.3
90% CI	0.6	1.1	0.6	0.4	0.0	0.6	1.2	1.2	0.3	1.0	1.0	1.9	0.3

6 DEGREE APPROACH -- TARGET IAS 75KTS.

NO DATA

TABLE NO. A.1-10.2

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 10 CENTERLINE CENTER (FLUSH) JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
500 FT. FLYOVER -- TARGET IAS 135 KTS.													
A3	90.5	83.6	6.9	6.5	0.4	95.9	97.2	98.9	6.4	96.1	11.5	12.5	1.8
A4	92.9	85.7	7.2	7.2	0.5	98.5	99.5	101.5	7.1	94.6	10.0	9.5	2.2
A5	90.1	82.6	7.5	6.5	0.4	95.7	95.9	97.6	6.7	95.7	14.0	16.0	1.9
A6	89.8	82.3	7.5	6.7	0.4	95.6	96.2	98.2	6.8	95.2	13.0	12.5	2.2
A7	90.1	82.9	7.2	6.4	0.4	96.0	96.3	97.9	6.8	96.1	13.5	15.5	2.1
A8	90.1	82.8	7.3	6.6	0.4	96.1	97.0	98.8	6.7	95.9	13.0	12.5	2.1
A9	90.2	82.6	7.6	6.5	0.4	95.8	95.8	97.6	7.0	96.6	14.5	14.5	2.0
A10	89.8	82.2	7.6	6.7	0.4	95.8	96.2	98.0	6.9	95.1	14.0	13.5	1.8
Avg.	90.4	83.1	7.4	6.6	0.4	96.2	96.8	98.6	6.8	95.7	12.9	13.3	2.0
Std Dv	1.0	1.1	0.2	0.3	0.0	1.0	1.2	1.3	0.2	0.7	1.5	2.1	0.2
90% CI	0.7	0.8	0.2	0.2	0.0	0.6	0.8	0.9	0.1	0.4	1.0	1.4	0.1
500 FT. FLYOVER -- TARGET IAS 120 KTS.													
B11	89.3	81.8	7.5	6.9	0.5	94.1	95.1	96.4	6.8	93.3	12.0	13.5	1.9
B12	89.5	81.9	7.6	6.8	0.4	95.2	95.1	96.9	7.2	93.2	13.0	14.0	1.9
B13	89.1	81.8	7.3	6.8	0.4	93.8	95.3	97.1	6.4	92.6	12.0	11.0	2.1
B14	89.5	82.3	7.3	6.7	0.4	95.2	95.9	97.8	7.0	92.3	12.0	11.5	2.1
Avg.	89.3	81.9	7.4	6.8	0.5	94.6	95.4	97.1	6.9	92.9	12.3	12.5	2.0
Std Dv	0.2	0.2	0.2	0.1	0.0	0.7	0.4	0.6	0.3	0.5	0.5	1.5	0.2
90% CI	0.2	0.3	0.2	0.1	0.0	0.8	0.4	0.7	0.4	0.6	0.6	1.7	0.2
500 FT. FLYOVER -- TARGET IAS 105 KTS													
C15	88.8	80.2	8.5	7.4	0.3	93.5	93.6	95.3	7.2	90.0	14.5	13.5	1.8
C16	88.9	81.1	7.8	6.9	0.4	93.9	94.2	95.5	7.3	92.0	13.5	14.0	1.5
C17	88.8	80.8	8.0	7.2	0.5	93.6	94.1	95.5	7.2	91.6	13.0	13.5	1.5
C18	88.9	80.4	8.5	7.4	0.5	93.3	93.6	94.5	7.6	91.5	14.0	14.5	1.1
C19	89.0	81.3	7.7	7.0	0.5	93.8	94.5	95.6	7.4	91.7	12.5	13.0	1.3
C20	88.9	80.8	8.1	7.0	0.5	93.8	93.8	95.6	7.3	91.5	14.0	13.5	1.6
Avg.	88.9	80.8	8.1	7.2	0.5	93.7	94.0	95.3	7.3	91.4	13.6	13.7	1.5
Std Dv	0.1	0.4	0.3	0.2	0.0	0.2	0.4	0.4	0.1	0.7	0.7	0.5	0.3
90% CI	0.1	0.3	0.3	0.2	0.0	0.2	0.3	0.3	0.1	0.6	0.6	0.4	0.2
1000 FT. FLYOVER — TARGET IAS 135 KTS.													
D21	85.6	76.4	9.2	6.8	0.4	90.9	89.3	90.8	7.3	89.8	22.5	24.0	1.4
D22	85.6	75.9	9.8	7.1	0.4	90.5	88.1	89.7	7.8	89.3	23.5	25.0	1.9
D23	85.6	76.6	9.0	6.8	0.4	90.9	89.4	90.7	7.4	90.3	20.5	23.0	1.4
D24	85.7	76.3	9.4	6.9	0.4	91.2	89.0	90.7	7.2	89.9	23.0	28.5	2.1
D25	86.2	77.2	9.0	7.1	0.4	91.4	89.1	91.5	7.6	90.3	18.0	19.5	2.8
Avg.	85.8	76.5	9.3	7.0	0.4	91.0	89.0	90.7	7.5	89.9	21.5	24.0	1.9
Std Dv	0.3	0.5	0.3	0.2	0.0	0.3	0.5	0.6	0.2	0.4	2.3	3.3	0.6
90% CI	0.2	0.5	0.3	0.1	0.0	0.3	0.5	0.6	0.2	0.4	2.2	3.1	0.6

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

T -10.1

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 10 CENTERLINE-CENTER (FLUSH) JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 75KTS. (ICAO)													
NO DATA													
TAKEOFF -- TARGET IAS 75 KTS. (ICAO)													
E26	98.2	91.5	6.7	6.5	0.4	103.3	103.7	106.9	6.3	92.4	10.5	10.0	3.2
E27	96.9	89.9	7.0	6.2	0.4	102.4	102.7	105.7	6.1	90.8	13.5	12.5	3.0
E28	97.6	89.0	8.6	7.1	0.5	102.2	101.5	104.4	7.1	91.2	13.5	13.0	2.7
E29	97.9	90.4	7.5	6.8	0.4	103.4	102.9	106.1	6.7	90.9	12.5	12.0	3.3
E30	97.5	90.2	7.3	7.0	0.5	103.0	102.7	105.8	6.9	90.9	11.0	11.0	3.1
E31	97.3	89.8	7.6	6.8	0.4	102.8	102.2	105.4	6.7	90.3	13.0	12.5	3.2
E32	97.2	89.5	7.7	7.0	0.5	102.6	101.8	105.0	6.8	90.6	12.5	13.0	3.2
E33	97.5	90.1	7.5	7.2	0.5	103.1	102.9	105.8	6.9	91.6	11.0	11.5	2.9
Avg.	97.4	90.6	7.4	6.8	0.5	102.8	102.6	105.6	6.7	91.1	12.2	11.9	3.1
Std Dv	0.4	0.7	0.4	0.3	0.0	0.4	0.7	0.8	0.3	0.7	1.2	1.1	0.2
90% CI	0.3	0.5	0.3	0.2	0.0	0.3	0.5	0.5	0.2	0.4	0.8	0.7	0.1

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-1.3

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/14/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 1 CENTERLINE - CENTER JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
TAKEOFF -- TARGET IAS 75KTS. (T/O FROM HOVER)													
6A37	95.3	90.3	5.1	6.0	0.5	100.5	103.0	105.6	5.8	91.9	7.0	7.0	2.6
6A38	94.1	88.6	5.4	6.2	0.5	99.2	101.3	104.0	5.9	90.7	7.5	7.5	2.6
6A39	94.6	89.8	4.8	6.2	0.5	100.1	103.0	105.5	5.9	92.2	6.0	6.0	2.7
6A40	95.3	90.0	5.3	6.3	0.5	100.7	103.3	105.4	6.1	92.6	7.0	7.5	2.1
Avg.	94.8	89.7	5.2	6.2	0.5	100.1	102.6	105.1	5.9	91.9	6.9	7.0	2.5
Std Dv	0.6	0.7	0.3	0.1	0.0	0.7	0.9	0.8	0.1	0.8	0.6	0.7	0.3
90% CI	0.7	0.8	0.3	0.2	0.0	0.8	1.1	0.9	0.2	0.9	0.7	0.8	0.3
TAKEOFF -- TARGET IAS 75KTS. (T/O FROM GROUND)													
6B41	94.1	87.4	6.7	6.3	0.4	[illegible]	99.4	103.1	6.4	88.1	11.5	8.5	3.7
6B42	93.6	87.2	6.3	6.1	0.4	98.2	99.2	102.5	6.3	88.5	11.0	8.0	3.3
6B43	92.5	85.9	6.6	6.1	0.4	97.6	97.6	101.3	5.9	86.7	12.0	11.5	3.7
6B44	93.2	86.1	7.0	6.4	0.4	97.9	97.6	101.4	6.6	86.9	12.5	10.0	3.8
6B45	92.5	85.7	6.7	6.0	0.4	97.3	97.6	101.1	5.7	86.8	13.9	12.5	3.4
Avg.	93.2	86.5	6.7	6.2	0.4	98.0	98.3	101.9	6.2	87.4	12.0	10.1	3.6
Std Dv	0.7	0.8	0.3	0.2	0.0	0.7	1.0	0.9	0.4	0.8	0.8	1.9	0.2
90% CI	0.7	0.7	0.2	0.2	0.0	0.7	0.9	0.9	0.4	0.8	0.8	1.8	0.2
[illegible] DEGREE APPROACH -- TARGET IAS 75KTS.													
6M52	94.5	87.3	7.2	6.8	0.5	98.5	101.1	102.1	6.3	98.0	11.5	10.5	0.9
6M53	90.5	82.3	8.2	7.1	0.5	94.3	95.3	96.2	7.1	93.9	14.0	14.0	0.9
6M54	91.2	83.1	8.1	6.9	0.4	94.9	96.4	97.2	7.2	94.6	15.0	11.5	0.9
6M55	92.8	85.4	7.4	6.9	0.5	96.7	98.8	99.7	6.7	95.6	12.0	11.0	1.0
6M56	92.6	85.9	6.6	6.5	0.4	96.6	99.6	100.6	6.2	96.4	10.5	9.5	1.0
Avg.	92.3	84.8	7.5	6.8	0.4	96.2	98.2	99.2	6.7	95.7	12.6	11.3	0.9
Std Dv	1.6	2.1	0.6	0.2	0.0	1.7	2.4	2.4	0.5	[illegible]	1.9	1.7	0.1
90% CI	1.5	2.0	0.6	0.2	0.0	1.6	2.2	2.3	0.4	1.5	1.8	1.6	0.1

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-1.2

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/13/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 1 CENTERLINE - CENTER JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
500 FT. FLYOVER -- TARGET IAS 135 KTS.													
A3	85.4	79.3	6.0	6.3	0.4	90.4	92.6	93.6	6.5	90.3	9.0	11.0	1.0
A4	88.4	81.8	6.6	7.1	0.5	93.7	95.0	96.5	7.6	88.0	8.5	9.0	1.8
A5	84.8	78.1	6.7	6.3	0.4	90.5	91.3	92.6	6.6	89.6	11.5	15.5	1.3
A6	84.8	78.1	6.7	6.5	0.4	90.1	91.4	92.9	7.2	87.2	10.5	10.0	1.5
A7	84.6	7[illegible].9	6.8	6.4	0.4	90.4	91.3	92.3	6.8	89.2	11.5	15.5	1.5
A8	84.6	78.0	6.6	6.6	0.5	90.0	91.4	92.6	7.1	87.7	10.0	11.5	1.4
A9	84.4	77.9	6.5	6.2	0.4	89.8	90.6	92.1	6.6	89.2	11.0	14.5	1.3
A10	84.0	77.1	6.9	6.7	0.5	89.3	90.5	91.9	7.1	86.7	10.5	11.0	1.1
Avg.	85.1	78.5	6.6	6.5	0.4	90.5	91.8	93.1	6.9	88.5	10.3	12.2	1.4
Std Dv	1.4	1.4	0.3	0.3	0.0	1.4	1.5	1.5	0.4	1.3	1.1	2.5	0.2
90% CI	0.9	1.0	0.2	0.2	0.0	0.9	1.0	1.0	0.2	0.9	0.7	1.7	0.2
500 FT. FLYOVER -- TARGET IAS 120 KTS.													
B11	84.3	77.5	6.8	6.7	0.5	88.7	90.6	91.6	7.0	85.7	10.5	10.5	1.5
B12	84.6	77.6	7.0	6.7	0.5	89.6	90.4	91.9	7.2	85.9	11.0	12.0	1.5
B13	84.3	77.4	6.9	6.6	0.4	88.8	90.6	91.6	7.1	86.0	11.0	10.5	1.2
B14	84.7	78.4	6.3	6.3	0.4	89.9	91.1	93.6	6.5	85.4	10.0	9.0	2.5
Avg.	84.5	77.7	6.7	6.6	0.4	89.3	90.7	92.2	6.9	85.8	10.6	10.5	1.7
Std Dv	0.2	0.5	0.3	0.2	0.0	0.6	0.3	1.0	0.3	0.3	0.5	1.2	0.6
90% CI	0.2	0.5	0.3	0.2	0.0	0.7	0.3	1.1	0.3	0.3	0.6	1.4	0.7
500 FT. FLYOVER -- TARGET IAS 105 KTS.													
C15	83.9	76.1	7.8	6.9	0.4	88.6	89.2	91.4	6.7	83.4	13.5	11.5	2.3
C16	84.2	77.0	7.1	6.6	0.4	88.5	89.8	91.0	7.0	86.0	12.0	12.0	1.2
C17	84.0	76.9	7.1	6.7	0.5	88.6	89.4	91.1	7.1	85.1	11.5	11.5	1.6
C18	83.9	76.0	7.9	7.0	0.5	87.9	88.7	90.3	7.0	85.8	13.5	12.0	1.6
C19	84.3	77.1	7.2	6.7	0.4	88.6	89.7	91.2	6.9	85.1	12.0	11.5	1.6
C20	84.3	76.8	7.5	6.8	0.4	88.6	89.4	91.2	7.0	85.4	12.5	11.5	1.8
Avg.	84.1	76.7	7.4	6.8	0.4	88.5	89.4	91.0	7.0	85.2	12.5	11.7	1.7
Std Dv	0.2	0.5	0.3	0.1	0.0	0.3	0.4	0.4	0.1	0.9	0.8	0.3	0.4
90% CI	0.2	0.4	0.3	0.1	0.0	0.2	0.3	0.3	0.1	0.8	0.7	0.2	0.3
1000 FT. FLYOVER -- TARGET IAS 135 KTS.													
D21	79.9	71.6	8.3	6.7	0.4	84.7	83.9	95.9	6.7	83.1	17.5	20.0	2.1
D22	79.6	70.5	9.1	7.1	0.4	84.1	82.7	[illegible]3.8	7.5	82.3	19.0	23.0	1.2
D23	80.0	72.8	7.2	6.3	0.4	84.4	84.5	86.7	6.4	82.9	14.0	16.0	2.2
D24	80.1	70.9	9.2	7.2	0.4	84.8	83.7	85.0	7.3	82.5	18.5	22.0	1.4
D25	80.6	72.9	7.7	6.6	0.4	84.8	84.2	86.7	6.9	82.3	14.5	15.0	2.8
Avg.	80.0	71.8	8.3	6.8	0.4	84.5	83.8	85.6	7.0	82.6	16.7	19.2	1.9
Std Dv	0.3	1.1	0.9	0.4	0.0	0.3	0.7	1.2	0.5	0.4	2.3	3.6	0.6
90% CI	0.3	1.0	0.8	0.4	0.0	0.3	0.7	1.2	0.4	0.4	2.2	3.4	0.6

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.1-1.1

AEROSPATIALE SA-365N HELICOPTER (DAUPHIN)

DOT/TSC
10/13/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 1 CENTERLINE - CENTER JUNE 6,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 75 KTS. (ICAO)													
F35	92.9	86.6	6.3	6.5	0.5	96.2	99.0	100.2	6.0	94.1	9.5	10.0	1.3
F36	90.8	83.3	7.5	6.9	0.5	94.6	96.7	97.7	6.5	94.8	12.5	11.5	1.0
F46	92.6	85.1	7.5	7.0	0.5	96.5	98.5	99.7	6.6	95.1	12.0	10.5	1.3
F47	92.9	85.9	7.0	6.5	0.4	96.5	98.7	99.7	6.5	95.3	12.0	11.0	1.1
F48	93.1	85.4	7.7	6.8	0.4	97.1	99.1	100.2	6.3	95.3	13.5	12.0	1.1
F49	92.8	84.9	7.9	7.1	0.5	97.0	98.5	99.6	7.1	94.9	13.0	11.0	1.1
F50	93.3	85.5	7.8	6.9	0.4	97.1	98.4	99.8	6.8	95.1	13.5	12.0	1.4
F51	93.5	87.8	5.6	5.6	0.4	97.0	100.5	101.4	5.6	96.4	10.0	10.0	0.9
Avg.	92.7	85.6	7.2	6.7	0.4	96.5	98.7	99.8	6.4	95.1	12.0	11.0	1.1
Std Dv	0.8	1.3	0.8	0.5	0.0	0.8	1.0	1.0	0.4	0.6	1.5	0.8	0.2
90% CI	0.6	0.9	0.5	0.3	0.0	0.6	0.7	0.7	0.3	0.4	1.0	0.5	0.1
TAKEOFF -- TARGET IAS 75 KTS. (ICAO)													
E26	93.7	87.1	6.5	6.5	0.5	98.8	99.4	102.6	6.3	87.6	10.0	9.5	3.2
E27	93.0	85.9	7.1	6.7	0.4	98.4	98.3	101.4	6.6	86.1	11.5	11.0	3.3
E28	93.2	87.0	6.2	6.3	0.4	98.6	99.0	102.7	6.1	87.0	9.5	9.0	3.7
E29	92.2	85.0	7.2	6.5	0.4	97.4	96.6	99.9	6.8	85.4	12.5	12.5	3.3
E30	92.8	86.4	6.4	6.1	0.4	98.7	99.3	102.7	5.8	88.0	11.5	11.0	3.5
E31	92.6	85.9	6.7	6.5	0.4	97.9	97.7	101.2	6.4	86.1	11.0	11.0	3.5
E32	92.7	85.4	7.3	6.6	0.4	97.9	97.2	100.7	6.7	86.3	12.5	12.0	3.6
E33	93.0	85.7	7.3	6.9	0.5	98.3	98.2	101.3	6.8	86.6	11.5	11.0	3.0
Avg.	92.9	86.1	6.8	6.5	0.4	98.3	98.2	101.6	6.4	86.6	11.2	10.9	3.4
Std Dv	0.4	0.7	0.4	0.2	0.0	0.5	1.0	1.0	0.3	0.8	1.1	1.2	0.2
90% CI	0.3	0.5	0.3	0.2	0.0	0.3	0.7	0.7	0.2	0.6	0.7	0.8	0.2

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE A.b

Definitions

A brief synopsis of Appendix A data column headings is presented.

EV	Event Number
SEL	Sound Exposure Level, the total sound energy measured within the period determined by the 10 dB down duration of the A-weighted time history. Reference duration, 1-second.
ALm	A-weighted Sound Level(maximum)
SEL-ALm	Duration Correction Factor
K(A)	A-weighted duration constant where: $K(A) = (SEL-ALm) \div (\text{Log } DUR(A))$
Q	Time History Shape Factor, where: $Q = (10^{0.1(SEL-ALm)} \div (DUR(A))$
EPNL	Effective Perceived Noise Level
PNLm	Perceived Noise Level(maximum)
PNLTm	Tone Corrected Perceived Noise Level(maximum)
K(P)	Constant used to obtain the Duration Correction for EPNL, where: $K(P) = (EPNL-PNLTm + 10) \div (\text{Log } DUR(P))$
OASPLm	Overall Sound Pressure Level(maximum)
DUR(A)	The 10 dB down Duration Time for the A-weighted time history
DUR(P)	The 10 dB down Duration Time for the PNLT time history
TC	Tone Correction calculated at PNLTm

Each set of data is headed by the site number, microphone location and test date. The target reference condtions are specified above each data subset.